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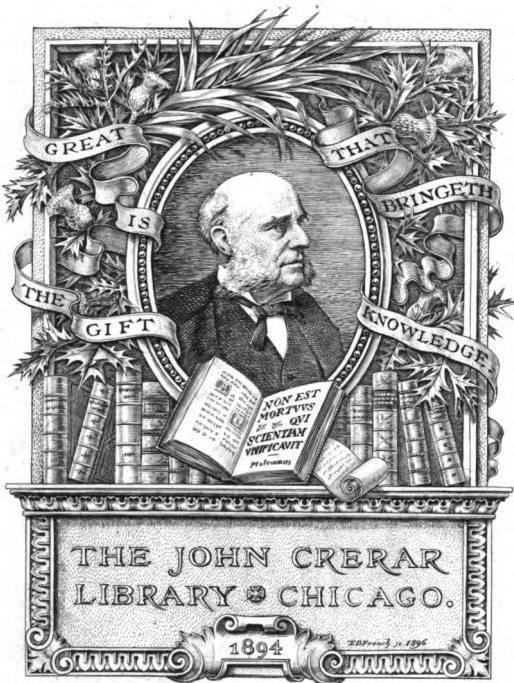


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**SMALL
TOOLS**

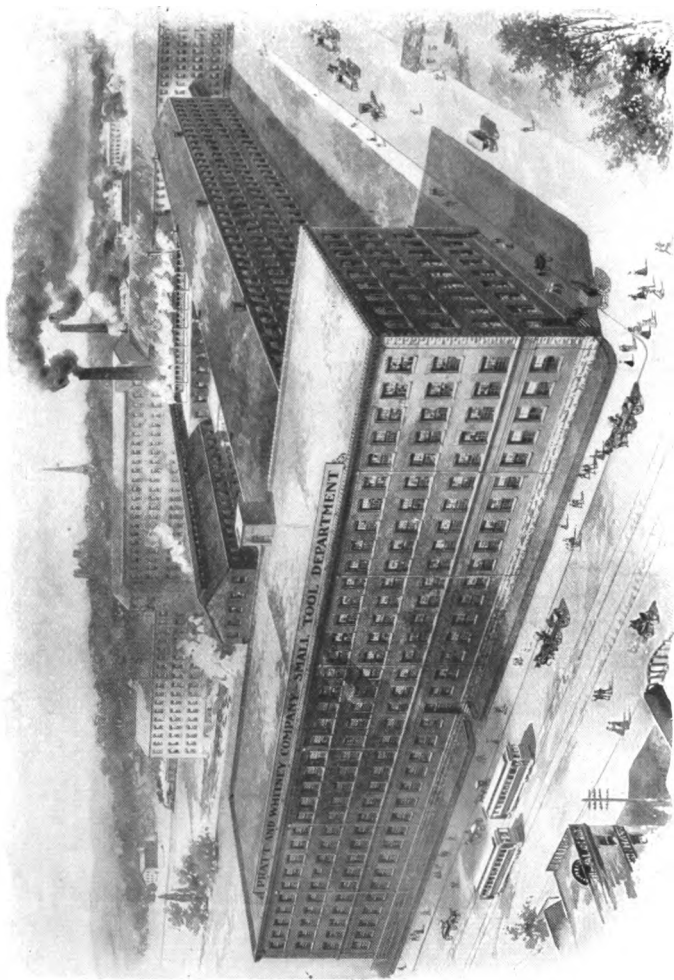
*STANDARDS
AND GAUGES*



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SMALL TOOL DEPARTMENT

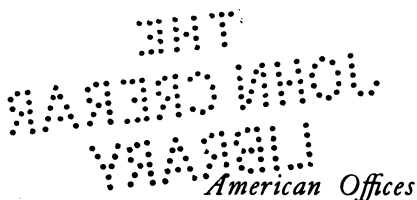
Manufacturers of
TAPS AND DIES,
DIE STOCK SETS FOR
BOLT AND PIPE THREADING,
MILLING CUTTERS,
SLITTING SAWS,
RENSHAW RATCHET DRILLS,
LATHE TOOLS,
TWIST DRILLS,
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REAMERS,
TAPER PINS,
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By Reading and Carefully Observing
the following suggestions, customers will assist us in filling their orders promptly and often save several days' delay, consumed in writing for more complete specifications.

Taps *In ordering taps, mention the exact diameter, form of thread, number of threads to the inch, and the style of tap; also state, if hand, whether taper, plug or bottoming, "new" or old style; if machine, whether long thread or short thread of "tapper" style; if pipe or boiler, whether taper or straight; if pulley or stay-bolt, what length; if hob, whether pipe, short shank, long thread die, or Sellers.*

Dies State style of die; if chaser, give number of die, and whether for die-stock or bolt-cutter. If solid, state whether square or round giving size of square and thickness, and diameter if round. Also state what metal the die is to cut, whether iron or brass.

- **This Company will fill all orders for taps and dies with the U. S. Standard and the U. S. form of thread (except in the case of stay-bolt, patch-bolt and boiler taps), unless otherwise specified.**

Milling Cutters State diameter, width of face, and size of hole and keyway, and whether for plain or side milling.

SPECIAL TOOLS Accompany order with drawing, as we cannot be responsible for errors in special work, when drawings are not furnished.

Follow the names of tools as listed, and see that your order contains full instructions.

Parties ordering goods sent by mail do so at their own risk.

We carry in stock all articles listed, except those marked special. The variety in all lines is very large and constantly increasing, and we especially urge customers to use from the stock list wherever it is possible rather than have special tools made, as this necessarily increases the price.

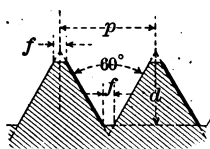
Any departure from lists in size, form, etc., will be classed as special and subject to special prices.

We Advise and Strongly Recommend the
adoption and use of the United States Standard thread for bolts and nuts, and for all screw threads where this is possible, using the U. S. form, with a greater number of threads per inch if desired for special work, thus entirely superseding the use of the sharp "V" and over size makeshifts.

The United States Standard thread is peculiarly adapted for interchangeable work, which is impossible with the sharp "V" and impracticable with any other known. It is simple in every element of its construction, reduces detail in shop practice, and tends to economy in cost of manufacture, as it does in cheapening cost of repairs. It brings order out of confusion, reduces the number of sizes and pitches, and consequently saves time, patience and money.

159800

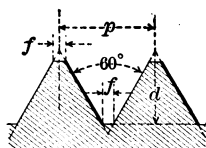
United States Standard Thread



$$\text{Formula} \left\{ \begin{array}{l} p = \text{pitch} = \frac{1}{\text{No. threads per inch}} \\ d = \text{depth} = p \times .64952 \\ f = \text{flat} = \frac{p}{8} \end{array} \right.$$

Diameter Inches	No. Threads per Inch	Diameter Inches	No. Threads per Inch	Diameter Inches	No. Threads per Inch	Diameter Inches	No. Threads per Inch
$\frac{1}{4}$	20	1	8	$2\frac{1}{8}$	$4\frac{1}{2}$	$3\frac{1}{4}$	$3\frac{1}{2}$
$\frac{5}{16}$	18	$1\frac{1}{8}$	7	$2\frac{1}{4}$	$4\frac{1}{2}$	$3\frac{3}{8}$	$3\frac{1}{4}$
$\frac{3}{8}$	16	$1\frac{1}{4}$	7	$2\frac{3}{8}$	4	$3\frac{1}{2}$	$3\frac{1}{4}$
$\frac{7}{16}$	14	$1\frac{3}{8}$	6	$2\frac{1}{2}$	4	$3\frac{5}{8}$	$3\frac{1}{4}$
$\frac{1}{2}$	13	$1\frac{1}{2}$	6	$2\frac{3}{8}$	4	$3\frac{3}{4}$	3
$\frac{9}{16}$	12	$1\frac{5}{8}$	$5\frac{1}{2}$	$2\frac{3}{4}$	4	$3\frac{7}{8}$	3
$\frac{5}{8}$	11	$1\frac{3}{4}$	5	$2\frac{7}{8}$	$3\frac{1}{2}$	4	3
$\frac{3}{4}$	10	$1\frac{7}{8}$	5	3	$3\frac{1}{2}$		
$\frac{7}{8}$	9	2	$4\frac{1}{2}$	$3\frac{1}{8}$	$3\frac{1}{2}$		

International and French Standard Thread (Metric System)



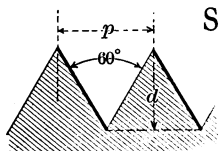
$$\text{Formula} \left\{ \begin{array}{l} p = \text{pitch} \\ d = \text{depth} = p \times .64952 \\ f = \text{flat} = \frac{p}{8} \end{array} \right.$$

International Standard

Diameter Millimeters	Pitch Millimeters	Diameter Millimeters	Pitch Millimeters	Diameter Millimeters	Pitch Millimeters
6	1.0	20	2.5	48	5.0
7	1.0	22	2.5	52	5.0
8	1.25	24	3.0	56	5.5
9	1.25	27	3.0	60	5.5
10	1.5	30	3.5	64	6.0
11	1.5	33	3.5	68	6.0
12	1.75	36	4.0	72	6.5
14	2.0	39	4.0	76	6.5
16	2.0	42	4.5	80	7.0
18	2.5	45	4.5		

French Standard

Diameter Millimeters	Pitch Millimeters	Diameter Millimeters	Pitch Millimeters	Diameter Millimeters	Pitch Millimeters
3	0.5	16	2.0	36	4.0
4	0.75	18	2.5	38	4.0
5	0.75	20	2.5	40	4.0
6	1.0	22	2.5	42	4.5
7	1.0	24	3.0	44	4.5
8	1.0	26	3.0	46	4.5
9	1.0	28	3.0	48	5.0
10	1.5	30	3.5	50	5.0
12	1.5	32	3.5		
14	2.0	34	3.5		



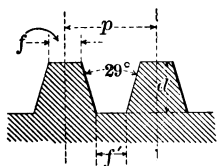
Sharp "V" Thread

Formula

$$\begin{cases} p = \text{pitch} = \frac{1}{\text{No. threads per inch}} \\ d = \text{depth} = p \times .86603 \end{cases}$$

Diameter Inches	No. Threads per Inch	Diameter Inches	No. Threads per Inch	Diameter Inches	No. Threads per Inch	Diameter Inches	No. Threads per Inch
1/4	20	7/8	9	2	4 1/2	3 1/4	3 1/2
5/16	18	1 1/8	9	2 1/8	4 1/2	3 3/8	3 1/4
3/8	16	1	8	2 1/4	4 1/2	3 1/2	3 1/4
7/8	14	1 1/8	7	2 3/8	4 1/2	3 5/8	3 1/4
1/2	12	1 1/4	7	2 1/2	4	3 3/4	3
9/16	12	1 3/8	6	2 5/8	4	3 7/8	3
5/8	11	1 1/2	6	2 3/4	4	4	3
1 1/8	11	1 5/8	5	2 7/8	4		
1 1/4	10	1 3/4	5	3	3 1/2		
1 1/2	10	1 7/8	4 1/2	3 1/8	3 1/2		

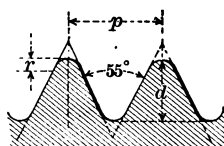
Acme Standard Screw Thread



Formula

$$\begin{cases} p = \text{pitch} = \frac{1}{\text{No. threads per inch}} \\ d = \text{depth} = \frac{1}{2} p + .010 \\ f = \text{flat on top of thread} = p \times .3707 \\ f' = \text{" on bottom " " " " } = p \times .3707 - .0052 \end{cases}$$

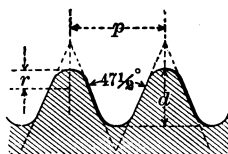
Whitworth Standard Thread



Formula $\left\{ \begin{array}{l} p = \text{pitch} = \frac{1}{\text{No. threads per inch}} \\ d = \text{depth} = p \times .64033 \\ r = \text{radius} = p \times .1373 \end{array} \right.$

Diameter Inches	No. Threads per Inch	Diameter Inches	No. Threads per Inch	Diameter Inches	No. Threads per Inch	Diameter Inches	No. Threads per Inch
$\frac{1}{4}$	20	$\frac{7}{8}$	9	2	4½	$3\frac{1}{4}$	$3\frac{1}{4}$
$\frac{5}{16}$	18	$\frac{15}{16}$	9	$2\frac{1}{8}$	4½	$3\frac{3}{8}$	$3\frac{1}{4}$
$\frac{3}{8}$	16	1	8	$2\frac{1}{4}$	4	$3\frac{1}{2}$	$3\frac{1}{4}$
$\frac{7}{8}$	14	$1\frac{1}{8}$	7	$2\frac{3}{8}$	4	$3\frac{5}{8}$	$3\frac{1}{4}$
$\frac{1}{2}$	12	$1\frac{1}{4}$	7	$2\frac{1}{2}$	4	$3\frac{3}{4}$	3
$\frac{9}{16}$	12	$1\frac{3}{8}$	6	$2\frac{5}{8}$	4	$3\frac{7}{8}$	3
$\frac{5}{8}$	11	$1\frac{1}{2}$	6	$2\frac{3}{4}$	3½	4	3
$\frac{11}{16}$	11	$1\frac{5}{8}$	5	$2\frac{7}{8}$	3½		
$\frac{3}{4}$	10	$1\frac{3}{4}$	5	3	3½		
$\frac{13}{16}$	10	$1\frac{7}{8}$	4½	$3\frac{1}{8}$	3½		

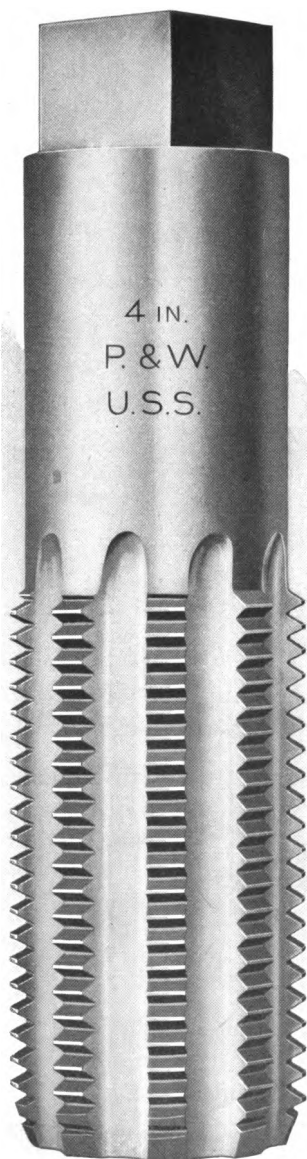
British Association Standard Thread



Formula $\left\{ \begin{array}{l} p = \text{pitch} \\ d = \text{depth} = p \times .6 \\ r = \text{radius} = \frac{2 \times p}{11} \end{array} \right.$

No.	Diameter m m	Pitch (p) m m	No.	Diameter m m	Pitch (p) m m
0	6.0	1.00	7	2.5	0.48
1	5.3	0.90	8	2.2	0.43
2	4.7	0.81	9	1.9	0.39
3	4.1	0.73	10	1.7	0.35
4	3.64	0.66	12	1.3	0.28
5	3.2	0.59	14	1.0	0.23
6	2.8	0.53	16	.79	0.19

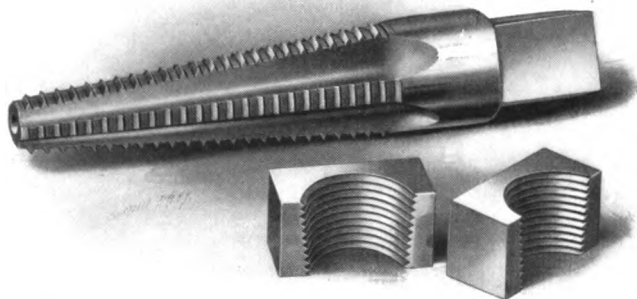
Tap Section



Echols' Patent Taps

Interrupted Thread

For Hand, Machine Nut, Pipe, Stay-bolt and Boiler Taps,
Where the Outside Diameter is not Less than $\frac{1}{2}$ Inch



The tap illustrated above has a taper of 2 inches per foot, having a diameter of $\frac{5}{8}$ inch at small end and 4 inches of thread.

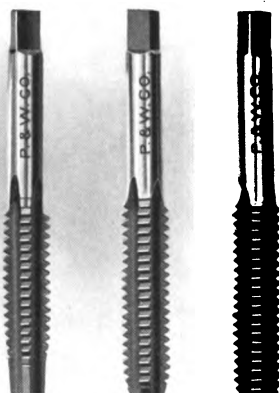
The nut shows condition of thread after tap had been driven its entire length without reversing.

The improvement over the full thread tap is especially noticeable in stay-bolt and boiler taps, and wherever the former is operated by hand the power required to drive the tap is 50 per cent. less than that of the full thread.

It is practically impossible to mutilate a thread with these taps.

Recommended for tapping all kinds of tough metal, such as copper, gun metal, nickel steel, boiler sheets, dome rings, mud or washout holes in locomotive boilers, etc.

No. 0 Hand Taps



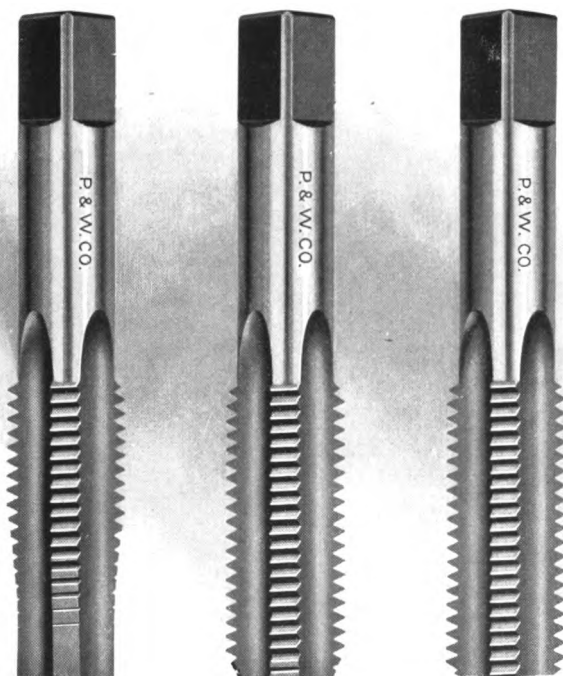
Diam. of Tap Inches	Price Each	Price per Set	Number of Threads to the Inch			
			U. S. St'd	Whit- worth St'd	V Form	Other V Threads also Furnished
$\frac{1}{16}$	\$0 35	\$1 05	64	60	72	60, 64
$\frac{5}{64}$	35	1 05	....	....	72	56, 60, 64
$\frac{3}{32}$	35	1 05	50	48	56	48, 50, 54, 60
$\frac{7}{64}$	35	1 05	....	....	56	48
$\frac{1}{8}$	35	1 05	40	40	40	32, 36, 48, 50
$\frac{9}{64}$	35	1 05	....	....	40	32, 36
$\frac{5}{32}$	35	1 05	36	32	32	30, 36, 40
$\frac{11}{64}$	35	1 05	....	....	32	36
$\frac{3}{16}$	35	1 05	32	24	24	30, 32, 36
$\frac{13}{64}$	35	1 05	....	....	24	32
$\frac{7}{32}$	35	1 05	28	24	24	32
$\frac{15}{64}$	35	1 05	....	....	24	32
$\frac{1}{4}$	35	1 05	20	20	20	24, 27, 32
$\frac{17}{64}$	35	1 05	....	....	20	32

These taps are made with shanks squared to fit one solid wrench.

A set consists of taper, plug and bottoming.

Machinists' Hand Taps

Process Patented August 15, 1899



In addition to the list of sizes and pitches given on the following page, we furnish at regular prices the following:

Over sizes in U. S. S., $\frac{1}{4}$ to 2 inches, inclusive, $\frac{1}{32}$ inch large

$\frac{1}{4}$ to $\frac{5}{8}$ inch, inclusive, $\frac{1}{64}$ inch large

Over sizes in V form, $\frac{1}{4}$ to 2 inches, inclusive, $\frac{1}{32}$ inch large

$\frac{1}{4}$ to $\frac{5}{8}$ inch, inclusive, $\frac{1}{64}$ inch large

Left-hand in U. S. Standard, $\frac{1}{4}$ to $1\frac{1}{2}$ inches, inclusive.

Taps with square thread or of unusual form or odd dimensions are made only to order and at special rates.

U. S. Standard taps, with the interrupted thread, in sizes of $\frac{1}{2}$ to $1\frac{1}{2}$ inches diameter, inclusive, carried in stock.

Taps over $1\frac{1}{2}$ inches diameter, with the interrupted thread, made to order at special prices.

For prices, see following page.

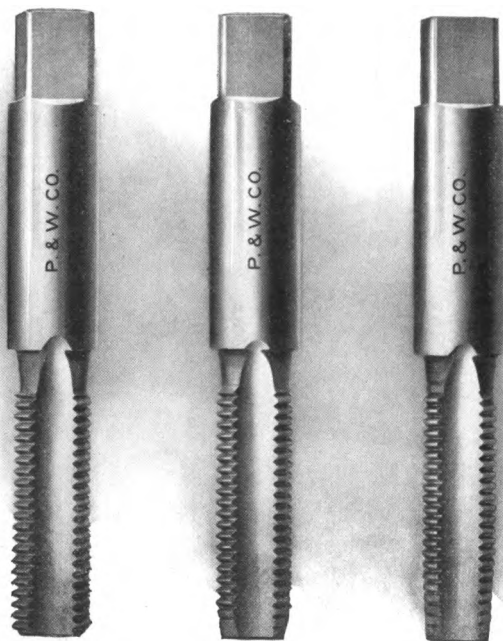
Sizes and Prices of Machinists' Hand Taps

Diam- eter of Tap Inches	Price Each	Price per Set	Number of Threads to the Inch				Total Length Inches
			U. S. St'd	Whit- worth St'd	V Form	Other V Threads also Furnished	
$\frac{3}{16}$	\$0 35	\$1 05	32	24	24	30, 32, 36	$2\frac{3}{8}$
$\frac{1}{4}$	45	1 35	20	20	20	24, 27, 32	$2\frac{1}{2}$
$\frac{5}{16}$	50	1 50	18	18	18	20, 24, 27, 32	$2\frac{3}{8}$
$\frac{3}{8}$	55	1 65	16	16	16	14, 18, 20, 24, 27	$2\frac{1}{2}$
$\frac{7}{16}$	60	1 80	14	14	14	12, 16, 20, 24, 27	$3\frac{3}{8}$
$\frac{1}{2}$	70	2 10	13	12	12	13, 14, 16, 20, 24, 27	$3\frac{3}{8}$
$\frac{9}{16}$	80	2 40	12	12	12	14, 27	$3\frac{1}{2}$
$\frac{5}{8}$	90	2 70	11	11	11	10, 12, 20, 24, 27	$3\frac{1}{2}$
$\frac{11}{16}$	1 05	3 15	11	11	11	10, 12	$4\frac{1}{2}$
$\frac{3}{4}$	1 20	3 60	10	10	10	12, 20, 27	$4\frac{1}{4}$
$\frac{13}{16}$	1 40	4 20	10	10	10	12	$4\frac{1}{2}$
$\frac{7}{8}$	1 60	4 80	9	9	9	10, 12, 27	$4\frac{1}{2}$
$\frac{15}{16}$	1 80	5 40	9	9	9	12	$4\frac{3}{8}$
1	2 00	6 00	8	8	8	12, 27	$5\frac{1}{8}$
$1\frac{1}{16}$	2 15	6 45	8	..	8	12	$5\frac{1}{8}$
$1\frac{1}{8}$	2 25	6 75	7	7	7	8, 12	$5\frac{7}{8}$
$1\frac{3}{16}$	2 45	7 35	7	..	7	....	$5\frac{7}{8}$
$1\frac{1}{4}$	2 60	7 80	7	7	7	12	$5\frac{3}{4}$
$1\frac{5}{16}$	2 80	8 40	7	..	7	....	$5\frac{3}{4}$
$1\frac{3}{8}$	3 00	9 00	6	6	6	....	$6\frac{1}{8}$
$1\frac{7}{16}$	3 25	9 75	6	..	6	....	$6\frac{1}{8}$
$1\frac{1}{2}$	3 50	10 50	6	6	6	....	$6\frac{3}{8}$
$1\frac{5}{8}$	4 20	12 60	$5\frac{1}{2}$	5	5	....	$6\frac{1}{2}$
$1\frac{3}{4}$	5 00	15 00	5	5	5	....	7
$1\frac{7}{8}$	5 80	17 40	5	$4\frac{1}{2}$	$4\frac{1}{2}$	....	$7\frac{5}{8}$
2	6 70	20 10	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$	....	$7\frac{5}{8}$
$2\frac{1}{8}$	8 00	24 00	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$	....	8
$2\frac{1}{4}$	9 20	27 60	$4\frac{1}{2}$	4	$4\frac{1}{2}$	....	$8\frac{1}{4}$
$2\frac{3}{8}$	10 50	31 50	4	4	$4\frac{1}{2}$	....	$8\frac{1}{2}$
$2\frac{1}{2}$	11 50	34 50	4	4	4	....	$8\frac{3}{4}$
$2\frac{3}{4}$	14 00	42 00	4	$3\frac{1}{2}$	4	....	$9\frac{1}{4}$
3	17 00	51 00	$3\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$	....	$9\frac{3}{4}$
$3\frac{1}{4}$	20 50	61 50	$3\frac{1}{2}$	$3\frac{1}{4}$	$3\frac{1}{2}$	....	10
$3\frac{1}{2}$	24 00	72 00	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	....	$10\frac{1}{4}$
$3\frac{3}{4}$	28 50	85 50	3	3	3	....	$10\frac{1}{2}$
4	32 50	97 50	3	3	3	....	$10\frac{3}{4}$

Hand taps, $\frac{3}{16}$ inch, with 24 threads per inch, U. S. form, and with 32 threads per inch, Whitworth form; also $\frac{1}{2}$ inch with 12 threads per inch, U. S. form, will be furnished at regular list and discount.

New-style Hand Taps

Process Patented August 15, 1899



Sets of hand taps, $\frac{1}{4}$ to $1\frac{1}{2}$ inches diameter, of U. S. Standard thread, are carried in stock of forms and dimensions found by experiment to be peculiarly adapted for use of locomotive builders and others who wish to tap holes in frames, bed-plates, etc., with most ease in working and least liability of breaking the taps. A set consists of No. 1, No. 2, and No. 3, corresponding in order of using to taper, plug and bottoming.

For list prices for this type of tap, see page 13.

Other than U. S. Standard sizes will be furnished to order at special rates.

Taps for Machine Screws

Process Patented August 15, 1899



Made of excellent steel, accurately finished and well tempered. Less than six of one size will be charged as single taps.

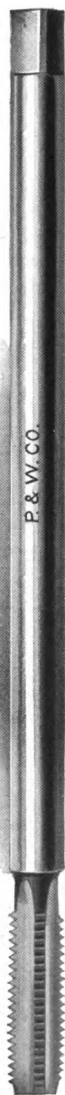
All sizes and threads not listed will be considered special, and subject to special prices.

Size of Screw Gauge	Standard No. of Threads per Inch	Threads per Inch also Furnished	Price	
			Each	Per Doz.
No. 1		56, 60, 64, 72	\$0 35	\$4 00
1½		56	35	4 00
2	56	48, 64	35	4 00
3	48	40, 56	35	4 00
4	36	32, 40, 42, 48	35	4 00
5	36	32, 40	35	4 00
6	32	30, 36, 38, 40, 48	35	4 00
7	32	30, 40	35	4 00
8	32	30, 36, 40	35	4 00
9	30	28, 32	35	4 00
10	24	28, 30, 32, 36	35	4 00
11	24	28, 30	35	4 00
12	24	20, 32	35	4 00
13	22	20, 24, 32	38	4 40
14	20	18, 24	38	4 40
15	20	18, 24	38	4 40
16	18	16, 20	38	4 40
18	18	16, 20	38	4 40
20	16	18	45	5 30
22	16	18	45	5 30
24	16	14, 18	45	5 30
26	16	14	53	6 30
28	14	16	53	6 30
30	14	16	53	6 30

When so ordered, the taps will be furnished in sets of taper, plug and bottoming forms, like hand taps.

Shanks on No. 1 to No. 5 are ⅛ inch diameter.

Shanks on No. 6 to No. 30 are equal to diameter of outside of thread.



Pulley Taps—U. S. Standard Thread

Process Patented August 15, 1899

Diameter Inches	Whole Length—Price, Each										Number of Threads to the Inch		
	6-inch	8-inch	10-inch	12-inch	14-inch	16-inch	18-inch	20-inch	22-inch	24-inch	United States Standard	V Form	Whit- worth Standard
$\frac{1}{4}$	\$0 65	\$0 70	\$0 80	\$0 90	....	....	....	....	....	....	20	20	20
$\frac{3}{8}$	75	80	1 00	1 20	....	....	....	....	....	....	18	18	18
$\frac{1}{2}$	80	90	1 10	1 30	\$1 40	\$1 55	\$1 70	....	....	....	16	16	16
$\frac{5}{8}$	90	1 00	1 20	1 40	1 50	1 65	1 80	....	....	....	14	14	14
$\frac{3}{4}$	1 00	1 15	1 30	1 45	1 60	1 75	1 90	\$2 05	....	....	13*	12*	12
$\frac{7}{8}$	1 10	1 30	1 45	1 55	1 70	1 85	2 05	2 20	\$2 35	....	12	12	12
$1\frac{1}{8}$	1 20	1 35	1 50	1 60	1 75	1 90	2 10	2 25	2 40	\$2 55	11	11	11
$1\frac{1}{4}$	1 30	1 45	1 55	1 70	1 90	2 05	2 20	2 35	2 50	2 65	11	11	11
$1\frac{3}{8}$	1 40	1 50	1 60	1 80	2 00	2 15	2 30	2 45	2 60	2 75	10	10	10
$1\frac{1}{2}$	1 60	1 70	1 80	2 00	2 15	2 30	2 45	2 60	2 75	2 90	10	10	10
$1\frac{3}{4}$	1 80	1 90	2 10	2 30	2 50	2 70	2 90	3 10	3 30	3 50	9	9	9
$2\frac{1}{8}$	2 00	2 10	2 30	2 50	2 70	2 90	3 10	3 30	3 50	3 70	9	9	9
$2\frac{1}{4}$	2 25	2 30	2 50	2 70	2 90	3 10	3 30	3 50	3 70	3 90	8	8	8

*We also furnish $\frac{1}{2}$ -inch pulley taps with 12 threads to the inch, United States Standard form, and 13 threads to the inch, V Standard form, at regular list and discount.

P. & W. CO.

Tapper Taps

Process Patented August 15, 1899

Diameter of Tap Inches	Price, Each				Number of Threads to the Inch			Length of Thread Inches
	Total Length 11 Inches	Total Length 12 Inches	Total Length 14 Inches	Total Length 15 Inches	U. S. Standard	Whitworth Standard	V Form	
1/4	\$0 70	\$0 75	\$0 80	\$0 90	20	20	20	1 3/4
5/16	80	85	90	1 00	18	18	18	2
3/8	90	95	1 00	1 10	16	16	16	2
7/16	1 00	1 05	1 15	1 25	14	14	14	2 1/4
1/2	1 12	1 15	1 25	1 35	13*	12	12*	2 1/4
9/16	1 30	1 35	1 45	1 55	12	12	12	2 1/2
5/8	1 45	1 50	1 65	1 75	11	11	11	2 1/2
11/16	1 62	1 70	1 80	1 95	11	11	11	2 1/2
3/4	1 80	1 85	2 00	2 10	10	10	10	2 3/4
7/8	2 05	2 10	2 25	2 35	10	10	10	2 3/4
15/16	2 35	2 45	2 60	2 75	9	9	9	3
1	2 70	2 75	3 00	3 15	9	9	9	3
1 1/16	3 15	3 20	3 50	3 65	8	8	8	3 1/2
1 1/8	3 60	3 70	3 95	4 10	7	7	7	3 1/2
1 1/4	4 15	4 25	4 50	4 65	7	7	7	3 1/2
1 3/8	4 70	4 80	5 05	5 20	6	6	6	4
1 1/2	5 30	5 40	5 65	5 80	6	6	6	4

*We also furnish 1/2-inch tapper taps with 12 threads to the inch, U. S. form, and 13 threads to the inch, V form, at regular list and discount.



Machine Nut Taps

Process Patented August 15, 1899

In addition to the list of sizes and pitches given on the following page, we furnish at regular prices the following:

Over sizes in U. S. S., $\frac{1}{4}$ to 2 inches, inclusive, $\frac{1}{32}$ inch large.

Over sizes in U. S. S., $\frac{1}{4}$ to $\frac{5}{8}$ inch, inclusive, $\frac{1}{64}$ inch large.

Over sizes in V form, $\frac{1}{4}$ to 2 inches, inclusive, $\frac{1}{32}$ inch large.

Over sizes in V form, $\frac{1}{4}$ to $\frac{5}{8}$ inch, inclusive, $\frac{1}{64}$ inch large.

Left-hand in U. S. Standard, $\frac{1}{4}$ to $1\frac{1}{2}$ inches, inclusive.

Taps with square thread or of unusual form or odd dimensions are made only to order and at special rates.

U. S. Standard taps, with the interrupted thread, in sizes of $\frac{1}{2}$ to $1\frac{1}{2}$ inches diameter, inclusive, carried in stock.

Taps over $1\frac{1}{2}$ inches diameter, with the interrupted thread, made to order at special prices.

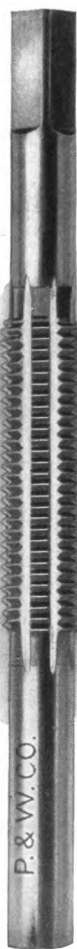
For prices, see following page.

Sizes and Prices of Machine Nut Taps

Diameter of Tap Inches	Price Each	Number of Threads to the Inch				Length of Thread Inches	Total Length Inches
		U. S. St'd	Whit- worth St'd	V Form	Other V Threads also Furnished		
$\frac{3}{16}$	\$0 60	32*	24*	24	32	$1\frac{1}{4}$	$4\frac{1}{2}$
$\frac{1}{4}$	60	20	20	20	24	$1\frac{3}{8}$	5
$\frac{5}{16}$	70	18	18	18	16, 20, 24	$1\frac{1}{2}$	$5\frac{1}{2}$
$\frac{7}{16}$	80	16	16	16	14, 18	$2\frac{1}{8}$	6
$\frac{1}{2}$	90	14	14	14	12, 16	$2\frac{1}{4}$	$6\frac{1}{2}$
$\frac{9}{16}$	1 00	13*	12	12	13	$2\frac{3}{8}$	7
$\frac{5}{8}$	1 15	12	12	12	14	$2\frac{1}{2}$	$7\frac{1}{2}$
$\frac{3}{4}$	1 30	11	11	11	10, 12	$2\frac{1}{2}$	8
$\frac{7}{8}$	1 45	11	11	11	12	$2\frac{3}{4}$	$8\frac{1}{2}$
1	1 60	10	10	10	12	$3\frac{1}{4}$	9
$1\frac{1}{8}$	1 80	10	10	10	12	$3\frac{1}{2}$	$9\frac{1}{2}$
$1\frac{1}{4}$	2 10	9	9	9	10, 12	$3\frac{1}{2}$	10
$1\frac{1}{2}$	2 40	9	9	9	12	$3\frac{3}{4}$	$10\frac{1}{2}$
$1\frac{3}{4}$	2 80	8	8	8	12	$4\frac{1}{8}$	11
2	3 00	8	....	8	....	$4\frac{1}{4}$	11
$2\frac{1}{8}$	3 20	7	7	7	8	$4\frac{1}{2}$	$11\frac{1}{2}$
$2\frac{1}{4}$	3 45	7	....	7	....	$4\frac{3}{4}$	$11\frac{1}{2}$
$2\frac{3}{8}$	3 70	7	7	7	....	$4\frac{7}{8}$	12
$2\frac{1}{2}$	3 95	7	....	7	....	$4\frac{7}{8}$	12
$2\frac{3}{4}$	4 20	6	6	6	....	$5\frac{1}{8}$	$12\frac{1}{2}$
3	4 45	6	....	6	....	$5\frac{1}{4}$	$12\frac{1}{2}$
$3\frac{1}{8}$	4 70	6	6	6	....	$5\frac{1}{2}$	13
$3\frac{1}{4}$	5 30	$5\frac{1}{2}$	5	5	....	$5\frac{1}{2}$	$13\frac{1}{2}$
$3\frac{3}{8}$	6 00	5	5	5	....	$5\frac{1}{2}$	14
$3\frac{1}{2}$	6 80	5	$4\frac{1}{2}$	$4\frac{1}{2}$	....	$6\frac{1}{8}$	$14\frac{1}{2}$
4	7 70	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$	....	$6\frac{1}{8}$	15
$4\frac{1}{8}$	9 00	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$	....	$6\frac{1}{8}$	$15\frac{1}{2}$
$4\frac{1}{4}$	10 20	$4\frac{1}{2}$	4	$4\frac{1}{2}$	....	$6\frac{1}{8}$	16
$4\frac{3}{8}$	11 50	4	4	$4\frac{1}{2}$	....	$6\frac{1}{8}$	$16\frac{1}{2}$
$4\frac{1}{2}$	12 50	4	4	4	....	$6\frac{7}{8}$	17
$4\frac{3}{4}$	15 00	4	$3\frac{1}{2}$	4	....	$6\frac{7}{8}$	18
5	18 00	$3\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$	....	$8\frac{1}{4}$	19
$5\frac{1}{8}$	21 50	$3\frac{1}{2}$	$3\frac{3}{4}$	$3\frac{1}{2}$	....	$8\frac{1}{4}$	$19\frac{1}{2}$
$5\frac{1}{4}$	25 00	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	....	$8\frac{1}{2}$	20
$5\frac{3}{8}$	29 50	3	3	3	....	9	$20\frac{1}{2}$
6	33 50	3	3	3	....	9	21

* Machine Nut Taps $\frac{3}{16}$ inch with 24 threads per inch, U. S. form, and with 32 threads per inch, Whitworth form; also $\frac{1}{2}$ inch with 12 threads per inch, U. S. form, will be furnished at regular list and discount.

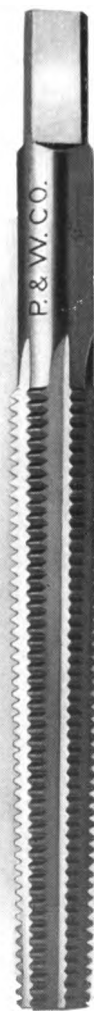
Hobs or Master Taps



Sellers Hob



Short-shank Die
Hob for Siz-
ing Dies



Long Taper Die
Tap for Cut-
ting Solid
Dies

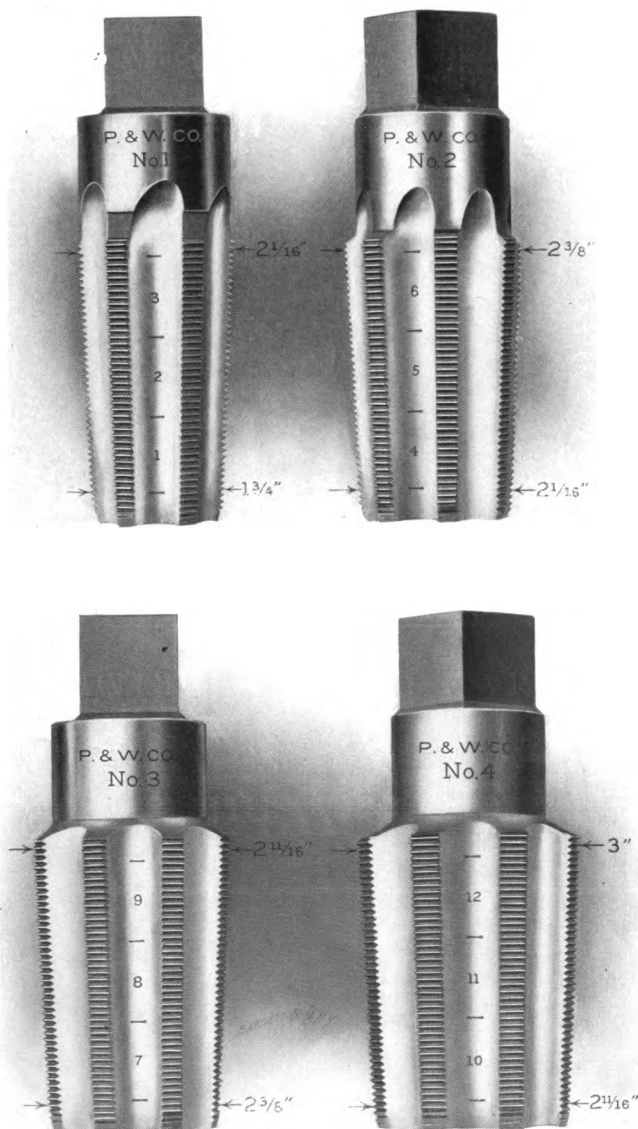
Short-shank Hobs, or Master Taps, Sellers Hobs and Long Taper Die Taps

Diameter Inches	Price, Each			Threads, per Inch		
	Short- shank Hobs	Sellers Hobs	Long Taper Die Taps	U. S. Standard	Whitworth Standard	V Form
$\frac{1}{4}$	\$0 60	\$0 90	\$0 75	20	20	20
$\frac{5}{16}$	70	1 05	87	18	18	18
$\frac{3}{8}$	80	1 20	1 00	16	16	16
$\frac{7}{16}$	90	1 35	1 12	14	14	14
$\frac{1}{2}$	1 00	1 50	1 25	13*	12	12
$\frac{9}{16}$	1 15	1 75	1 44	12	12	12
$\frac{5}{8}$	1 30	1 95	1 62	11	11	11
$\frac{11}{16}$	1 45	2 20	1 81	11	11	11
$\frac{3}{4}$	1 60	2 40	2 00	10	10	10
$\frac{13}{16}$	1 80	2 70	2 25	10	10	10
$\frac{7}{8}$	2 10	3 15	2 62	9	9	9
$\frac{15}{16}$	2 40	3 60	3 00	9	9	9
1	2 80	4 20	3 50	8	8	8
$1\frac{1}{8}$	3 20	4 80	4 00	7	7	7
$1\frac{1}{4}$	3 70	5 55	4 62	7	7	7
$1\frac{3}{8}$	4 20	6 30	5 25	6	6	6
$1\frac{1}{2}$	4 70	7 05	5 87	6	6	6
$1\frac{3}{4}$	5 30	7 95	6 62	$5\frac{1}{2}$	5	5
$1\frac{7}{8}$	6 00	9 00	7 50	5	5	5
$1\frac{15}{16}$	6 80	10 20	8 50	5	$4\frac{1}{2}$	$4\frac{1}{2}$
2	7 70	11 55	9 62	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$

* We also furnish $\frac{1}{2}$ -inch sizes with 12 threads to the inch, U. S. form, at regular list and discount.

Hobs or die taps with left-hand thread, or of other pitches than named above, will be furnished to order at special prices.

Mud or Washout Taps



Mud or Washout Taps

Used for tapping washout holes in locomotives.

A set consists of four taps having $1\frac{1}{4}$ -inch taper in 12 inches.

Tap No. 1 is $1\frac{3}{4}$ inches in diameter at small end, and tap No. 4 is 3 inches in diameter at large end.

The taps are marked as shown in the illustrations and correspond with taper plugs bearing the same numbers as the twelve diameters shown in the four taps.

The taps are $6\frac{1}{2}$ inches long and all have the same size shank square.

Price, Each

No. 1	.....	\$ 6 00
No. 2	.....	7 50
No. 3	.....	9 00
No. 4	.....	10 50

The interrupted thread tap furnished at the same list prices.

These taps will be furnished with V form of thread, 12 to the inch, unless otherwise specified.

Stay-bolt Taps for Boiler Makers

Patented August 7, 1897

In ordering, state diameter, pitch and form of thread if other than 12 sharp "V" is wanted; also length of parts A, B, C, D and E.

Diameter given is that of the thread at its straight part.

Prices are for each inch of length 16 inches and upwards.

Taps shorter than 16 inches will be charged as if 16 inches long.

Prices of and blue prints for other styles of stay-bolt taps than the one shown in the cut will be furnished on application.

These taps will be furnished in either the interrupted or the ordinary thread, as desired.

Blank order slips furnished on application.

Stay-bolt taps 20 inches and 24 inches long, in sizes from $\frac{3}{4}$ to $1\frac{1}{2}$ inches diameter, in both the ordinary and interrupted thread, and having the following proportions, are carried in stock:

Dimensions in Inches

Total Length	A	B	C	D	E
20	1	6	$1\frac{1}{2}$	6	$5\frac{1}{2}$
24	1	8	2	6	7

Diameter, Inches

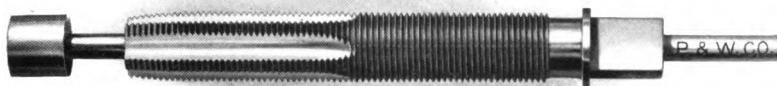
Price per Inch

$\frac{3}{4}$ to $\frac{7}{8}$, inclusive	\$0 40
$\frac{1}{2}$ to 1, inclusive	45
$1\frac{1}{8}$ to $1\frac{1}{4}$, inclusive	50
$1\frac{3}{8}$ to $1\frac{1}{2}$, inclusive	55
$1\frac{5}{8}$ to $1\frac{3}{4}$, inclusive	60
$1\frac{7}{8}$ to $1\frac{1}{2}$, inclusive	70



STAY BOLT TAP

Spindle Stay-bolt Taps



Used for retapping stay-bolt holes from the inside of fire-box of locomotives.

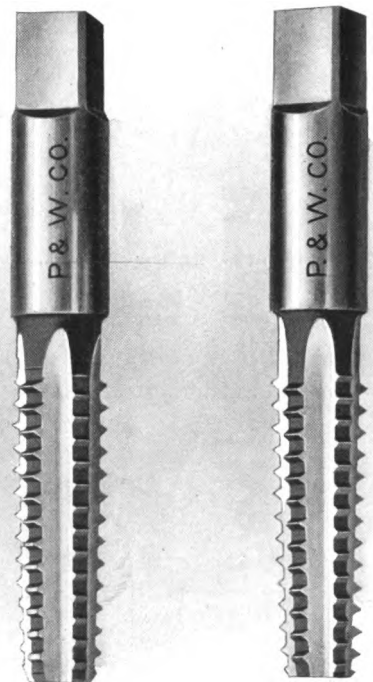
These taps will be furnished with "V" form of thread, 12 to the inch, unless otherwise specified.

Other sizes and lengths than those named below will be furnished to order at special prices.

Diameter of Tap Inches	Price Each	Length of Fluted Thread Inches	Length of Unfluted Thread Inches	Total Length Inches	Diameter of Spindle Inches	Length of Spindle Inches
$\frac{3}{4}$	\$8 00	$3\frac{1}{4}$	$2\frac{3}{4}$	7 $\frac{5}{8}$	$\frac{3}{8}$	11
$1\frac{1}{8}$	8 50	$3\frac{1}{4}$	$2\frac{3}{4}$	7 $\frac{5}{8}$	$\frac{3}{8}$	11
$1\frac{3}{8}$	9 00	$3\frac{1}{4}$	$2\frac{3}{4}$	7 $\frac{5}{8}$	$\frac{3}{8}$	11
$1\frac{1}{2}$	9 50	$3\frac{1}{4}$	$2\frac{3}{4}$	7 $\frac{5}{8}$	$\frac{3}{8}$	11
1	10 00	$3\frac{1}{4}$	$2\frac{3}{4}$	7 $\frac{5}{8}$	$\frac{3}{8}$	11
$1\frac{1}{8}$	10 50	$3\frac{1}{4}$	$2\frac{3}{4}$	7 $\frac{5}{8}$	$\frac{3}{8}$	11
$1\frac{1}{4}$	11 00	$3\frac{1}{4}$	$2\frac{3}{4}$	7 $\frac{5}{8}$	$\frac{3}{8}$	11
$1\frac{3}{8}$	11 50	$3\frac{1}{4}$	$2\frac{3}{4}$	7 $\frac{5}{8}$	$\frac{3}{8}$	11
$1\frac{1}{2}$	12 00	$3\frac{1}{4}$	$2\frac{3}{4}$	7 $\frac{5}{8}$	$\frac{3}{8}$	11
$1\frac{5}{8}$	12 25	$3\frac{1}{4}$	$2\frac{3}{4}$	7 $\frac{5}{8}$	$\frac{3}{8}$	11
$1\frac{3}{4}$	12 50	$3\frac{1}{4}$	$2\frac{3}{4}$	7 $\frac{5}{8}$	$\frac{3}{8}$	11
$1\frac{7}{8}$	12 75	$3\frac{1}{4}$	$2\frac{3}{4}$	7 $\frac{5}{8}$	$\frac{3}{8}$	11
$1\frac{1}{2}$	13 00	$3\frac{1}{4}$	$2\frac{3}{4}$	7 $\frac{5}{8}$	$\frac{3}{8}$	11

Straight and Taper Boiler Taps

Patented August 10, 1897



Straight
Boiler Tap

Taper
Boiler Tap

Sizes and Prices

Twelve Sharp "V" Threads to
the Inch

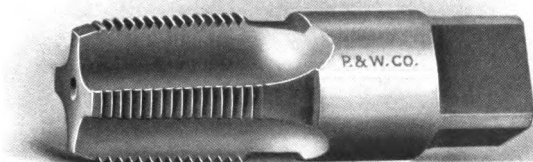
Diam. Inches	Price Each	Diam. Inches	Price Each
$\frac{1}{2}$	\$1 00	$1\frac{1}{4}$	\$3 70
$\frac{9}{16}$	1 15	$1\frac{5}{8}$	4 00
$\frac{5}{8}$	1 30	$1\frac{3}{4}$	4 30
$\frac{11}{16}$	1 45	$1\frac{7}{8}$	4 60
$\frac{3}{4}$	1 60	$1\frac{1}{2}$	4 90
$\frac{13}{16}$	1 80	$1\frac{5}{8}$	5 10
$\frac{7}{8}$	2 10	$1\frac{3}{4}$	5 40
$\frac{15}{16}$	2 40	$1\frac{7}{8}$	5 70
1	2 80	2	6 00
$1\frac{1}{16}$	3 00	$2\frac{1}{8}$	6 50
$1\frac{1}{8}$	3 20	$2\frac{1}{4}$	7 00
$1\frac{3}{16}$	3 40	$2\frac{3}{8}$	7 50
		$2\frac{1}{2}$	8 00

Cut shows taps with
interrupted thread.

Taper and straight boiler taps are carried in stock $\frac{1}{32}$ inch over size up to $1\frac{1}{4}$ inches, and will be furnished at same prices as standard sizes.

The above will be furnished in either the interrupted or the ordinary thread, as desired.

Patch-bolt Taps

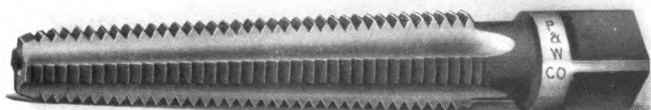


These taps are made especially for boiler makers. They are tapered $\frac{3}{4}$ of an inch to the foot for the purpose of making the bolt a *steam-tight* fit.

Patch-bolt taps $\frac{1}{2}$ inch over size will be furnished at regular prices. All sizes have 12 sharp "V" threads to the inch.

Diameter, Inches	Price, Each	Diameter, Inches	Price, Each
$\frac{1}{2}$	\$0 70	$\frac{1}{8}$	\$1 80
$\frac{9}{16}$	80	1	2 00
$\frac{5}{8}$	90	$1\frac{1}{8}$	2 15
$\frac{11}{16}$	1 05	$1\frac{1}{4}$	2 25
$\frac{3}{4}$	1 20	$1\frac{3}{8}$	2 45
$\frac{13}{16}$	1 40	$1\frac{1}{2}$	2 60
$\frac{7}{8}$	1 60		

Blacksmiths' Taper Taps



All sizes and threads not listed are special and subject to special prices. Taps have a taper of $\frac{3}{4}$ of an inch to the foot.

Diameter Inches	Price Each	No. Threads to Inch	Diameter Inches	Price Each	No. Threads to Inch
$\frac{1}{4}$	\$0 30	18, 20, 24	$\frac{3}{4}$	\$0 65	10, 12
$\frac{5}{16}$	30	16, 18, 20	$\frac{7}{8}$	90	9, 10
$\frac{3}{8}$	35	14, 16, 18	1	1 25	8
$\frac{7}{16}$	40	14, 16, 18	$1\frac{1}{8}$	1 50	7, 8
$\frac{1}{2}$	40	12, 13, 14, 16	$1\frac{1}{4}$	1 75	7, 8
$\frac{9}{16}$	50	12, 14	$1\frac{1}{2}$	3 00	6
$\frac{7}{8}$	50	10, 11, 12			

Taps for Beaman & Smith Holders



Fitting No. 1 Holder			Fitting No. 2 Holder		
Diameter Inches	Price Each	Number of Threads to Inch	Diameter Inches	Price Each	Number of Threads to Inch
$\frac{1}{4}$	\$0 45	20	$\frac{5}{8}$	\$0 90	11
$\frac{5}{16}$	50	18	$\frac{11}{16}$	1 05	11
$\frac{3}{8}$	55	16	$\frac{3}{4}$	1 20	10
$\frac{7}{16}$	60	14	$\frac{13}{16}$	1 40	10
$\frac{1}{2}$	70	13	$\frac{7}{8}$	1 60	9
$\frac{9}{16}$	80	12	$\frac{15}{16}$	1 80	9
$\frac{5}{8}$	90	11	1	2 00	8
			$1\frac{1}{8}$	2 25	7
			$1\frac{1}{4}$	2 60	7

Furnished in U. S. Standard and "V" form.

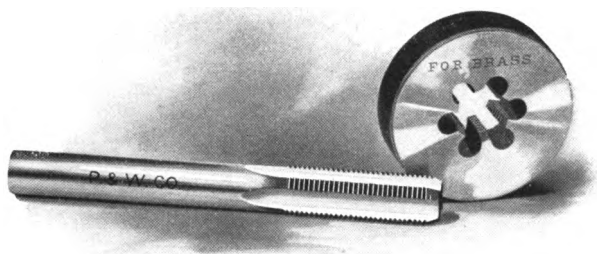
Taps for Use in Screw Machines



It is recommended that the diameter of the shank be of such a size as will fit, or may be easily bushed to fit, the holder for spring screw threading dies cutting corresponding U. S. Standard sizes. The exact diameter, pitch, form and length of thread, also diameter and length of shank, should be given with order.

Prices furnished on application.

Gas Fixture Taps and Dies



Brass and Iron Sizes

Standard sizes used in gas fixture manufacture, and wherever thin brass tubing is used.

Brass Pipe Sizes, all 27 Threads per Inch

Size Inches	Outside Diam. of Die Inches	Thickness of Die Inches	Price of Dies Each	Length of Tap Inches	Diam. of Shank of Tap Inches	Price of Taps Each
No. 4	$\frac{3}{8}$	$\frac{1}{4}$	\$0 40	$2\frac{1}{6}$	$\frac{1}{4}$	\$0 45
$\frac{1}{4}$	1	$\frac{5}{16}$	75	$2\frac{3}{4}$	$\frac{2}{8}$	45
$\frac{5}{16}$	1	$\frac{5}{16}$	75	$3\frac{1}{8}$	$\frac{2}{8}$	50
$\frac{3}{8}$	$1\frac{7}{8}$	$\frac{3}{8}$	1 00	$3\frac{1}{4}$	$\frac{3}{8}$	55
$\frac{7}{16}$	$1\frac{7}{8}$	$\frac{3}{8}$	1 00	$3\frac{1}{4}$	$\frac{3}{8}$	60
$\frac{1}{2}$	$1\frac{7}{8}$	$\frac{3}{8}$	1 00	$3\frac{1}{2}$	$\frac{3}{8}$	70
$\frac{9}{16}$	$1\frac{7}{8}$	$\frac{3}{8}$	1 00	$3\frac{1}{2}$	$\frac{7}{16}$	80
$\frac{5}{8}$	$1\frac{7}{8}$	$\frac{3}{8}$	1 00	$3\frac{1}{2}$	$\frac{1}{2}$	90
$\frac{3}{4}$	2	$\frac{1}{2}$	1 25	$3\frac{3}{4}$	$\frac{5}{8}$	1 20
$\frac{7}{8}$	2	$\frac{1}{2}$	1 25	4	$\frac{11}{16}$	1 60
1	2	$\frac{1}{2}$	1 25	4	$\frac{11}{16}$	2 00

Large and Small Ornament "Brass Sizes," all 32 Threads per Inch

.148	$\frac{5}{8}$	$\frac{1}{4}$	40	$2\frac{1}{8}$	$\frac{5}{32}$	45
.196	$\frac{5}{8}$	$\frac{1}{4}$	40	$2\frac{1}{4}$	$\frac{13}{64}$	45

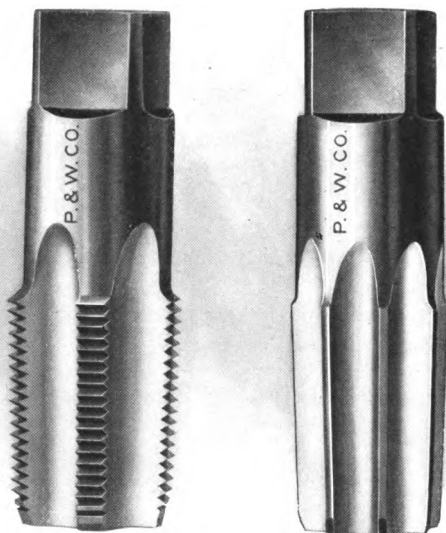
Straight Iron Pipe Sizes

$\frac{1}{8}$	$1\frac{7}{8}$	$\frac{3}{8}$	1 00	$3\frac{1}{4}$	$\frac{11}{16}$	1 12
$\frac{1}{4}$	$1\frac{7}{8}$	$\frac{3}{8}$	1 00	$3\frac{1}{4}$	$\frac{11}{16}$	1 25
$\frac{3}{8}$	$1\frac{7}{8}$	$\frac{3}{8}$	1 00	$3\frac{3}{8}$	$\frac{11}{16}$	1 50
$\frac{1}{2}$	2	$\frac{1}{2}$	1 25	4	$\frac{11}{16}$	1 87

Pipe Taps and Reamers

Briggs Standard

Patented August 10, 1897



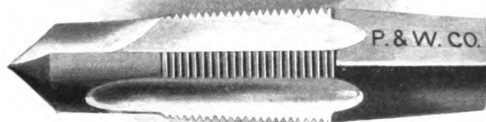
Pipe taps, with right- or left-hand threads, and reamers having taper $\frac{3}{4}$ inch per foot, are made in the following sizes, and kept in stock :

Size Inches	Price Each	Approximate Reamer Diameter at $\frac{3}{8}$ Inch from Point	Size Inches	Price Each	Approximate Reamer Diameter at $\frac{3}{8}$ Inch from Point
$\frac{1}{8}$	\$1 12	$\frac{11}{32}$	$1\frac{1}{2}$	\$4 62	$1\frac{3}{8}$
$\frac{1}{4}$	1 25	$\frac{7}{16}$	2	6 25	$2\frac{3}{16}$
$\frac{3}{8}$	1 50	$\frac{9}{16}$	$2\frac{1}{2}$	10 50	$2\frac{7}{8}$
$\frac{1}{2}$	1 87	$\frac{13}{16}$	3	15 00	$3\frac{1}{8}$
$\frac{3}{4}$	2 50	$\frac{15}{16}$	$3\frac{1}{2}$	22 00	$3\frac{5}{8}$
1	3 12	$1\frac{1}{8}$	4	33 00	$4\frac{1}{4}$
$1\frac{1}{4}$	3 75	$1\frac{7}{16}$			

Straight or plug pipe taps also furnished at above list.

The above taps will be furnished either in the interrupted or the ordinary thread, as desired.

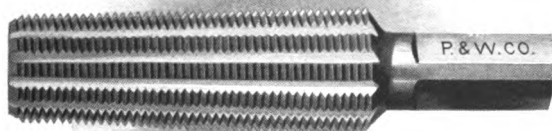
Pipe Tap and Drill Combined



Size Inches	Length Inches	Price Each	Size Inches	Length Inches	Price Each	Size Inches	Length Inches	Price Each
$\frac{1}{4}$	$3\frac{3}{4}$	\$1 50	$\frac{3}{4}$	$4\frac{1}{2}$	\$3 00	$1\frac{1}{2}$	$5\frac{1}{2}$	\$5 80
$\frac{3}{8}$	4	1 75	1	$4\frac{3}{4}$	3 80	2	$5\frac{3}{4}$	7 60
$\frac{1}{2}$	$4\frac{1}{4}$	2 20	$1\frac{1}{4}$	5	4 80	$2\frac{1}{2}$	$6\frac{1}{2}$	10 00

Pipe Hobs

Briggs Standard



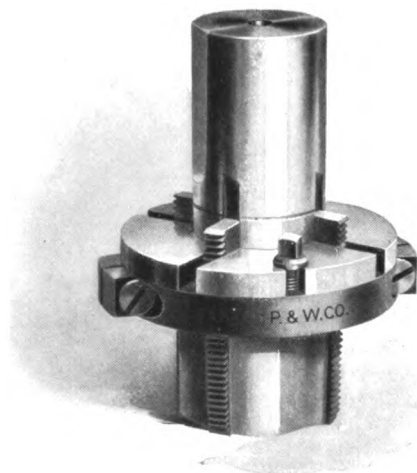
Pipe hobs or master pipe taps for cutting dies $\frac{3}{4}$ -inch taper to the foot; have fine flutes and extra length of thread; right- or left-hand.

Size Inches	Price Each	Size Inches	Price Each	Size Inches	Price Each
$\frac{1}{8}$	\$1 12	$\frac{3}{4}$	\$2 50	2	\$ 6 25
$\frac{1}{4}$	1 25	1	3 12	$2\frac{1}{2}$	10 50
$\frac{3}{8}$	1 50	$1\frac{1}{4}$	3 75	3	15 00
$\frac{1}{2}$	1 87	$1\frac{1}{2}$	4 62	$3\frac{1}{2}$	22 00
				4	33 00

Burritt's Patent Pipe Taps

With Adjustable and Detachable Cutters

Patented July 3, 1888

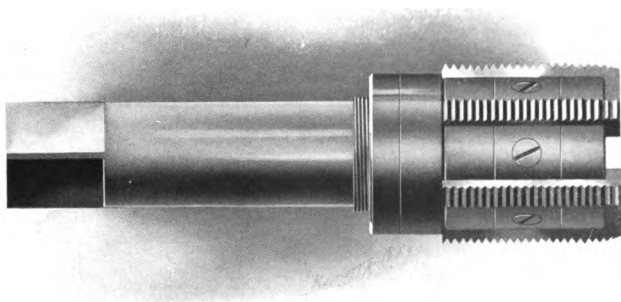


For threading steam, gas and water fittings, or other work, where a number of holes are to be tapped by machines.

Size of Tap Inches	Total Length Inches	Diameter of Shank Inches	Length of Tap Under Ring Inches	Size of Chasers Inches	Price of Tap Complete	Price of Chasers Each
1¼	7	1½	2	3¼ x ¼ x 9/16	\$20 00	\$0 50
1½	7	1½	2	3¼ x ¼ x 9/16	24 00	50
2	7	2½	1¾	3½ x 5/8 x 9/16	28 00	50
2½	7½	2½	2¼	4 x ¾ x ¾	34 00	60
3	7½	2½	2¼	4 x ¾ x ¾	38 00	60
3½	7½	3	2¼	4 x ¾ x ¾	42 00	60
4	7½	3	2¼	4 x ¾ x ¾	47 00	60
4½	7½	3	2¼	4 x ¾ x ¾	50 00	60
5	7½	4	2¼	4 x ¾ x ¾	53 00	60
6	7½	4	2¼	4 x ¾ x ¾	60 00	60

Inserted Cutter Tap

New Model



Made in sizes of $1\frac{1}{4}$ inches and larger.

It will be noted that this tap is free from any outside incumbrance, and takes up no more room than a solid tap.

It is equally serviceable in both straight and taper tapping. Prices given on application.

The Leland Tapping Attachment

Patented May 2, 1893

Can be used in any spindle, vertical or horizontal, having reversible movement. Is simple in construction, with no complicated parts to get out of order. Requires no readjustment from a small to a large tap, has a positive drive, and immediately the tap has reached the depth to be tapped it is released from all strain.

It is safe, convenient in handling, and can be operated by the most unskilled workman.

Tapping Attachment Complete

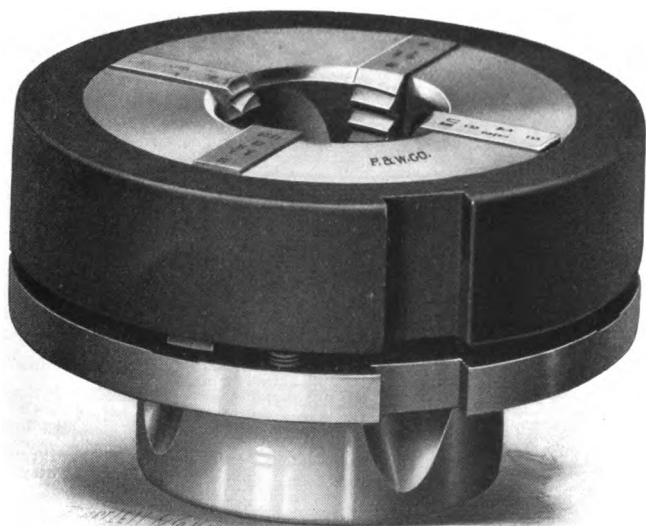
No. 1, with No. 4 Morse Taper Shank, carrying taps $\frac{3}{8}$ to $1\frac{1}{2}$ inches \$50 00

No. 2, with No. 3 Morse Taper Shank, carrying taps $\frac{1}{2}$ to $\frac{3}{8}$ inch . . . 35 00

Taps

No. 1 Head		No. 2 Head	
Size Inches	Price Each	Size Inches	Price Each
$\frac{3}{8}$	\$2 60	$\frac{1}{2}$	\$1 60
$\frac{1}{2}$	2 60	$\frac{3}{8}$	1 60
$\frac{3}{4}$	2 60	$\frac{5}{8}$	1 60
$\frac{1}{4}$	2 60	$\frac{1}{4}$	1 60
$\frac{7}{8}$	2 60	$\frac{3}{4}$	1 60
$\frac{1}{8}$	2 60	$\frac{1}{8}$	1 60
1	2 60	$\frac{7}{8}$	1 60
$1\frac{1}{8}$	2 60		
$1\frac{1}{4}$	2 60		
$1\frac{3}{8}$	3 00		
$1\frac{1}{2}$	3 50		

Die Section



Woodbridge Adjustable Solid Die

Patented March 12, 1889



The above cut represents the die for use in turret or monitor machines, bolt-cutters, stay-bolt threading machines, and is the best die that can be used in cutting *accurate screw threads*.

The shank has a hole bored true, into which can be fitted a projecting stud to be held in the regular die-holder of a monitor machine.

Dies are adjustable $\frac{1}{8}$ inch smaller and $\frac{1}{8}$ inch larger than standard size. The chasers can be removed and *sharpened*, without changing the adjustment. By loosening a small screw, the ring can be turned either way, and all chasers adjusted exactly alike.

Good, uniform threading can be done only with a *solid die*, but it cannot be sharpened easily, or adjusted when worn. This die has all the advantages of a solid die and none of the objections mentioned.

Bolt or Stud Dies

Carried in stock for United States Standard threads $1\frac{1}{2}$ inches and smaller.

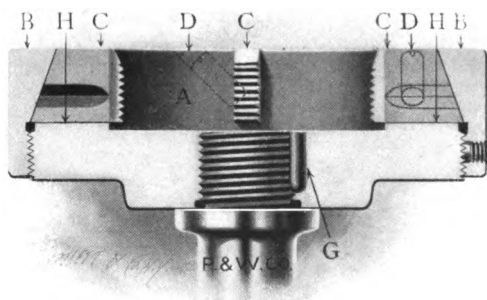
No.	To Cut Inches	Outside Diam. of Die Inches	Total Length Inches	Diam. of Shank Inches	Hole in Shank Inches	Prices	
						Die Complete	Set of Four Chasers
0	$\frac{1}{8}$ to $\frac{7}{16}$	$2\frac{1}{8}$	$1\frac{13}{16}$	$1\frac{3}{4}$	$\frac{1}{2}$	\$4 50	\$1 50
1	$\frac{1}{4}$ to $\frac{7}{8}$	$3\frac{1}{2}$	$2\frac{21}{32}$	$2\frac{1}{8}$ $2\frac{1}{2}$ 3	$1\frac{3}{8}$ $1\frac{5}{8}$ 2	4 50	1 50
2 & 3	$\frac{1}{2}$ to 1	$4\frac{1}{8}$	$3\frac{1}{32}$	$2\frac{1}{8}$ $2\frac{1}{2}$ 3	$1\frac{3}{8}$ $1\frac{5}{8}$ 2	5 00	1 80
4	$1\frac{1}{8}$ to $1\frac{1}{2}$	$4\frac{11}{16}$	$3\frac{11}{32}$	$2\frac{1}{2}$ 3	$1\frac{5}{8}$ 2	6 50	2 40
5	$1\frac{3}{8}$ to $2\frac{1}{4}$	6	...	to order	to order	special	special

Brass Workers' Die

Patented March 12, 1889

For Cutting Fine Threads on Large Diameters

Made Only to Order



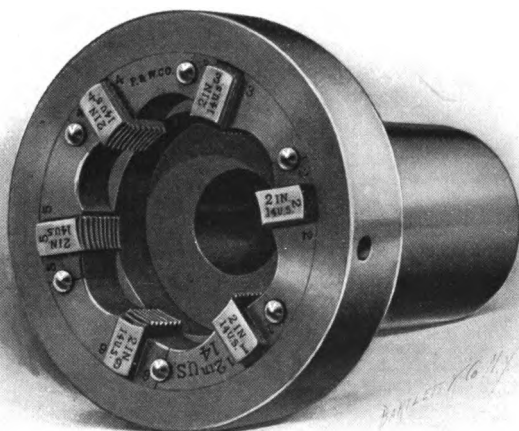
This is the same style of die as described on page 36, having the same advantage in adjustment, and is especially designed for brass workers in threading large diameters and fine pitches. In ordering, always state the number of threads per inch, length and diameter of thread to be cut, the largest outside diameter of die that can be used, with length and diameter of shank; also kind of metal to be cut, so that proper clearance can be given.

Orders for extra chasers should state the number of the die.

No.	To Cut Diameters Inches	Outside Diameter of Die Inches	Length and Diameter of Shank	Prices furnished on application
2	½ to 1	3	As ordered	
3	1 to 1½	3½		
4	1½ to 2	4		
5	2 to 2½	4½		
6	2½ to 3	5½		

New Model Die

Patented August 30, 1898

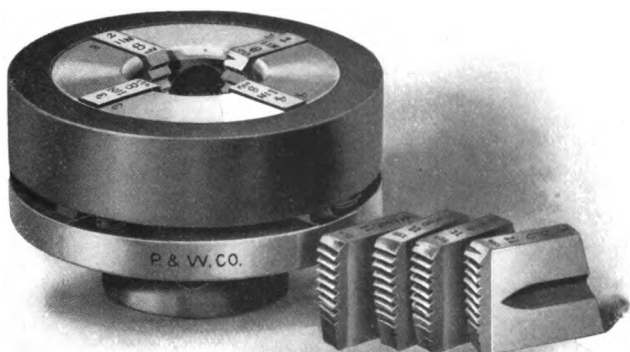


The die is so constructed that the chasers are locked rigidly in position and the cutting edges held in positive alignment. The chasers can be removed and sharpened without changing the adjustment. By referring to the table it will be seen that the die has a greater range from the smallest to the largest size in any number than it is possible to obtain in any other style die of like outside diameter.

No.	To Cut Diameters Inches	Outside Diameter of Die Inches	Prices furnished on application
1	$\frac{1}{8}$ to $\frac{1}{2}$	$2\frac{1}{8}$	
2	$\frac{1}{2}$ to $1\frac{5}{8}$	$3\frac{5}{16}$	
3	$1\frac{1}{2}$ to $2\frac{1}{4}$	$3\frac{3}{8}$	
4	$2\frac{1}{4}$ to $2\frac{7}{8}$	$4\frac{15}{32}$	
5	$2\frac{7}{8}$ to $3\frac{1}{2}$	$5\frac{3}{8}$	
6	$3\frac{1}{2}$ to $4\frac{1}{4}$	$6\frac{9}{16}$	

The Grant Adjustable Die

Practically Solid When in Use



The accompanying cut represents the die that will be furnished with Nos. 1, 2, 2½ hand, and Nos. 3 and 4 turret-head power bolt-cutters, and Nos. 1 to 4 die-stocks.

Dies are adjustable $\frac{1}{32}$ inch.

Chasers can be quickly removed for the purpose of grinding.

In ordering chasers, state whether they are for the Woodbridge or Grant bolt-cutter dies, or National bolt-cutter head, or for Nos. 1 to 4 die-stocks.

Chasers for either bolt-cutter collet for the same diameter screw or bolt are interchangeable. They are in width and thickness for $\frac{1}{4}$ to $\frac{7}{16}$ inch diameter, $\frac{3}{4} \times \frac{1}{4}$ inch; for $\frac{1}{2}$ to 1 inch diameter, $1 \times \frac{5}{16}$ inch; for $1\frac{1}{16}$ to $1\frac{1}{2}$ inches diameter, $1\frac{1}{4} \times \frac{3}{8}$ inch.

For full details and prices, see pages 40 to 48, inclusive.

No. 1 Set

Cutting Capacity, $\frac{3}{16}$ to $\frac{1}{2}$ -Inch

U. S. S., Whitworth Standard, or V Form

No. 1 die-stock, length 13 inches. Five dies, U. S. S., cutting $\frac{1}{4}$ -inch, 20; $\frac{5}{16}$ -inch, 18; $\frac{3}{8}$ -inch, 16; $\frac{7}{16}$ -inch, 14; $\frac{1}{2}$ -inch, 13.

Price with taper taps..... \$16 80

Price with taper and plug taps..... 18 90

Price with taper, plug and bottoming taps..... 21 00

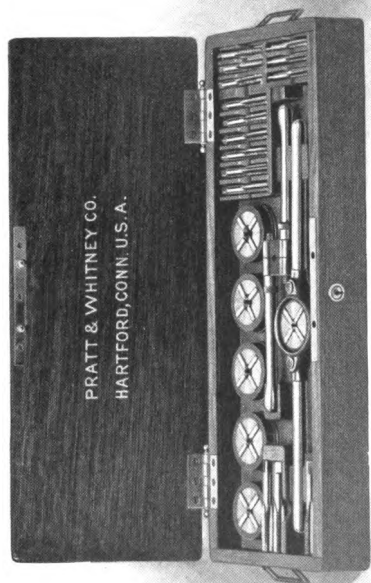
Additional dies, $\frac{3}{16}$ -inch, 32, can be furnished for this stock at regular listed prices on page 48.

One No. 2 adjustable tap wrench will be included with the above when complete set is ordered.

Prices for other combinations than those named above furnished on application.

For dies of special diameters and pitches, or left-hand thread, see detailed list of prices on page 48.

U. S. S. thread furnished unless otherwise specified.



No. 1 Set. U. S. S., Whitworth Standard, or V Form

No. 2 Set

Cutting Capacity, $\frac{1}{4}$ to $\frac{3}{4}$ -Inch

U. S. S., Whitworth Standard, or V Form

No. 2 die-stock, length 20 inches. Six dies, U. S. S., cutting $\frac{5}{16}$ -inch, 18; $\frac{3}{8}$ -inch, 16; $\frac{7}{16}$ -inch, 14; $\frac{1}{2}$ -inch, 13; $\frac{5}{8}$ -inch, 11; $\frac{3}{4}$ -inch, 10.

Price with taper taps.....	\$26 25
Price with taper and plug taps.....	29 10
Price with taper, plug and bottoming taps.....	32 95

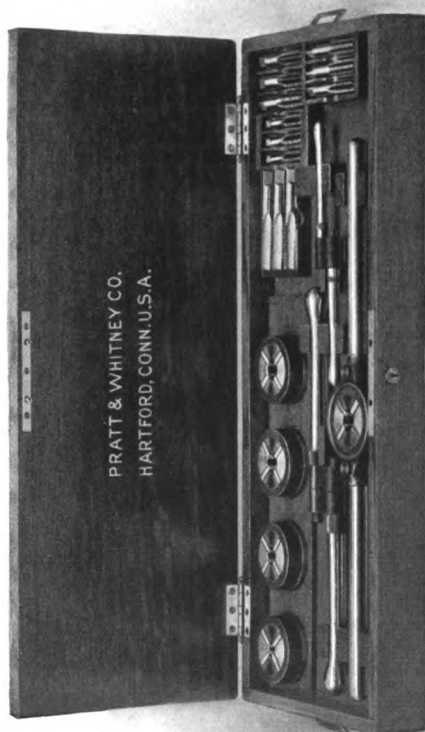
Additional dies, $\frac{1}{4}$ -inch, 20; $\frac{9}{16}$ -inch, 12; $\frac{11}{16}$ -inch, 11; also pipe dies $\frac{1}{8}$ -inch, $\frac{1}{4}$ -inch, $\frac{3}{8}$ -inch and $\frac{1}{2}$ -inch, Briggs Standard, can be furnished for this stock at regular list prices on page 48.

One No. 2 and one No. 3 adjustable tap wrench furnished with above when complete set is ordered.

Prices for other combinations than those named above furnished on application.

For dies of special diameters and pitches, or left-hand thread, see detailed list of prices on page 48.

U. S. S. thread furnished unless otherwise specified.



No. 2 Set. U. S. S., Whitworth Standard, or V Form

No. 3 Set

Cutting Capacity, $\frac{3}{8}$ to 1-Inch

U. S. S., Whitworth Standard, or V Form

No. 3 die-stock, length 30 inches. Five dies, U. S. S., cutting $\frac{1}{2}$ -inch, 13; $\frac{5}{8}$ -inch, 11; $\frac{3}{4}$ -inch, 10; $\frac{7}{8}$ -inch, 9; 1-inch, 8.

Price with taper taps	\$33 20
Price with taper and plug taps.....	38 00
Price with taper, plug and bottoming taps.....	42 80

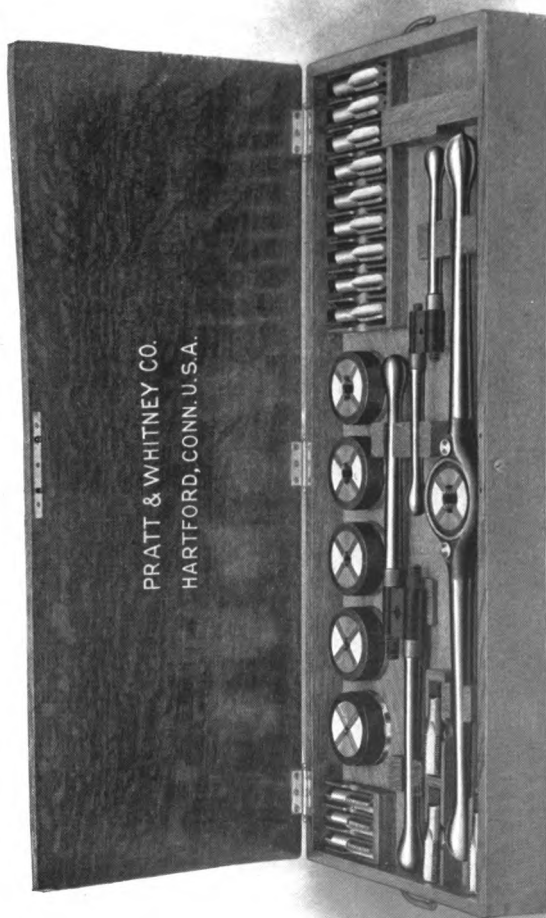
Additional dies, $\frac{3}{8}$ -inch, 16; $\frac{7}{16}$ -inch, 14; $\frac{9}{16}$ -inch, 12; $\frac{11}{16}$ -inch, 11; $\frac{13}{16}$ -inch, 10; $\frac{15}{16}$ -inch, 9; can be furnished for this stock at regular list prices on page 48.

One No. 3 and one No. 4 tap wrench will be included with above when complete set is ordered.

Prices for other combinations than those named above furnished on application.

For dies of special diameters and pitches, or left-hand thread, see detailed list of prices on page 48.

U. S. S. thread furnished unless otherwise specified.



No. 3 Set. U. S. S., Whitworth Standard, or V Form

No. 4 Set

Cutting Capacity, $\frac{3}{4}$ to $1\frac{1}{2}$ -Inch

U. S. S., Whitworth Standard, or V Form

No. 4 die-stock, length 48 inches. Six dies, U. S. S., cutting $\frac{7}{8}$ -inch, 9; 1-inch, 8; $1\frac{1}{8}$ -inch, 7; $1\frac{1}{4}$ -inch, 7; $1\frac{3}{8}$ -inch, 6; $1\frac{1}{2}$ -inch, 6.

Price with taper taps.....	\$59 75
Price with taper and plug taps.....	71 00
Price with taper, plug and bottoming taps.....	82 25

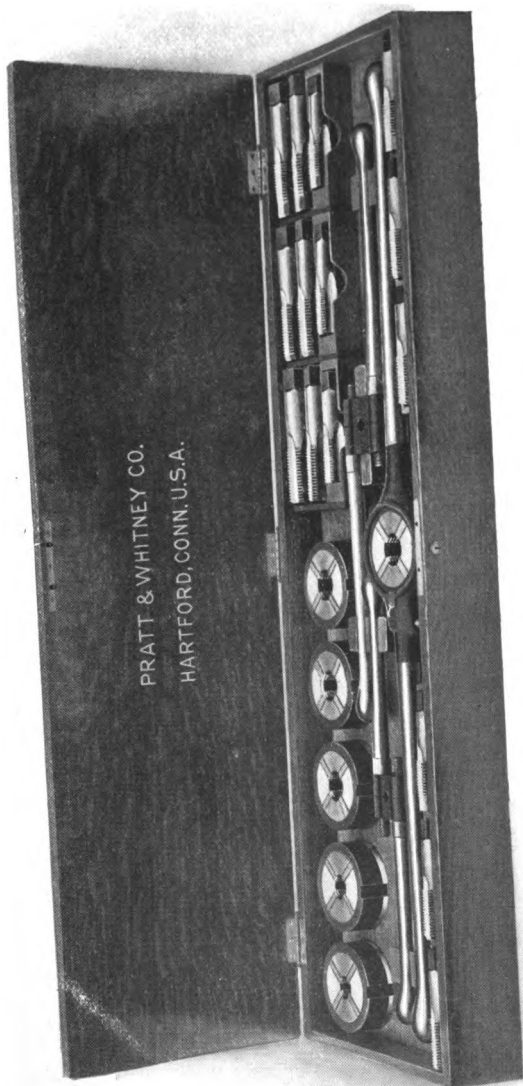
Additional dies, $\frac{3}{4}$ -inch, 10; $1\frac{3}{8}$ -inch, 10; $1\frac{5}{8}$ -inch, 9; $1\frac{1}{2}$ -inch, 8; $1\frac{3}{4}$ -inch, 7; $1\frac{7}{8}$ -inch, 7; $1\frac{1}{2}$ -inch, 6; also pipe dies $\frac{3}{4}$, 1 and $1\frac{1}{4}$ -inch, Briggs Standard, can be furnished for this stock at regular list prices on page 48.

One No. 4 and one No. 5 tap wrench will be included with the above when complete set is ordered.

Prices for other combinations than those named above furnished on application.

For dies of special diameters and pitches, or left-hand thread, see detailed list of prices on page 48.

U. S. S. thread furnished unless otherwise specified.



No. 4 Set. U. S. S., Whitworth Standard, or V Form

Dimensions and Prices of Die-stocks, Dies and Parts in Detail

	Die-stocks				Bolt-cutters		
	No. 1	No. 2	No. 3	No. 4	No. 1	Nos. 2, 3	No. 4
Box for regular set. Price.....	\$0 75	\$1 50	\$2 00	\$3 75	$\left. \begin{array}{l} 2\frac{1}{2} \text{ in.} \\ 2\frac{1}{2} \text{ in.} \\ 2\frac{1}{2} \text{ in.} \\ 2\frac{1}{2} \text{ in.} \\ 2\frac{1}{2} \text{ in.} \end{array} \right\} 2\frac{1}{2} \text{ in.}$		
Die-stock. Weight.....	12 oz.	2 lbs. 8 oz.	6 lbs.	16 lbs.			
Die-stock. Price.....	\$3 00	\$4 50	\$7 00	\$12 00			
Collet (also complete die). Outside diam.	1 $\frac{1}{8}$ in.	2 $\frac{3}{4}$ in.	3 $\frac{1}{4}$ in.	4 $\frac{1}{2}$ in.			
Collet, without screws or ring. Price.....	\$0 90	\$1 00	\$1 10	\$1 50			
Collet, with screws and ring. Price.....	1 50	1 70	1 90	2 60	3 $\frac{1}{2}$ in.	4 in.	4 $\frac{1}{2}$ in.
Ring only. Price.....	60	70	80	1 10	2 20	2 40	\$1 50
Screws, binding and adjusting. Price, each.....	05	05	05	05	90	1 00	1 10
Chasers. Width and thickness.	$\frac{1}{2} \times \frac{3}{8}$ in.	$1\frac{1}{8} \times \frac{1}{8}$ in.	1 x $\frac{1}{4}$ in.	1 $\frac{1}{4}$ x $\frac{3}{8}$ in.	05	05	05
Chasers, per set of four. Weight.....	1 oz.	2 $\frac{1}{2}$ oz.	5 oz.	11 oz.	5 oz.	7 oz.	8 oz.
Chasers, U. S. S., Whitworth Standard, and V Form, right-hand, and for iron pipe, right- or left-hand—							
Price, per single one.....	\$0 30	\$0 40	\$0 50	\$0 65	\$0 40	\$0 50	\$0 65
Price, per set of four.....	1 00	1 35	1 60	2 25	1 50	1 80	2 40
Chasers, U. S. and Whitworth Standards, left-hand, and right- or left-hand of any special pitch or form, except square thread. Price, per set of four—							
For which we have hob.....	1 60	2 10	2 60	3 40	2 10	2 60	3 40
For which hob must be made.....	4 60	5 40	6 60	8 20	5 40	6 60	8 20
Chasers, square thread. Price, per set —							
For which we have hob.....							
For which hob must be made.....							
Die, consisting of collet, ring, screws and four chasers. Weight.....	7 oz.	3 00	3 60	4 80	3 00	3 60	4 80
Die for U. S. or Whitworth Standard, right-hand, and iron pipe. Price.....	\$2 40	\$2 85	\$3 50	\$4 75	8 00	9 60	12 00
		1 lb. 4 oz.	2 lbs. 10 oz.	6 lbs. 8 oz.	3 lbs. 3 oz.	5 lbs. 5 lbs. 6 oz.	
					3 lbs. 3 oz.	5 lbs. 5 lbs. 6 oz.	
					\$3 50	\$4 00	\$5 00

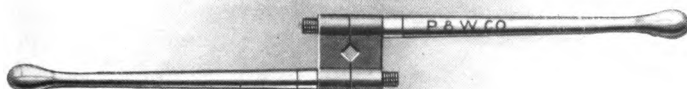
Die-stocks and Tap Wrenches



Style of die-stock furnished with Nos. 1, 2, 3 and 4 sets.

Adjustable Tap Wrench

Drop-forged



Price List of Drop-forged Tap Wrenches

		Size of Tap Shank Squares Inches	Price Each
New No. 1 fits	$\frac{1}{8}$ to $\frac{1}{4}$ -inch taps....	$\frac{3}{32}$ to $\frac{3}{16}$	\$1 25
New No. 2 fits	$\frac{1}{4}$ to $\frac{1}{2}$ -inch taps....	$\frac{3}{16}$ to $\frac{3}{8}$	1 75
New No. 3 fits	$\frac{7}{16}$ to $\frac{3}{4}$ -inch taps....	$\frac{5}{16}$ to $\frac{9}{16}$	2 65
New No. 4 fits	$\frac{11}{16}$ to 1-inch taps....	$\frac{1}{2}$ to $\frac{3}{4}$	4 60
New No. 5 fits	$\frac{13}{16}$ to 1½-inch taps...	$\frac{11}{16}$ to 1½	6 50

No. 0 Die-stock Set for Jewelers, Dentists, Tool Makers and Amateurs

Cutting Capacity, $\frac{1}{8}$ to $\frac{1}{16}$ -Inch



The taps for use with these sets are made taper, plug and bottoming, with shanks squared to fit one solid wrench.

The dies are $\frac{5}{8}$ -inch diameter, $\frac{1}{4}$ -inch thick, split on one side, and can be nicely adjusted by screws in the steel collets, the latter being $\frac{7}{8}$ -inch diameter, and are held in the stock by thumb-screw. These collets are provided with guides corresponding to the diameter of the wire to be threaded, thus insuring a perfectly true thread.

The following combinations are carried regularly in stock :

Set "A"

Contains stock, wrench and six sizes of taps, dies and collets ($\frac{3}{32}$ to $\frac{1}{4}$ inch, inclusive, by thirty-seconds) in wood case.

Price with plug taps.....	\$6 75
Price with taper and plug taps	8 75
Price with taper, plug and bottoming taps	10 75

Set "B"

Contains stock, wrench and seven sizes of taps, dies and collets ($\frac{1}{16}$ to $\frac{1}{4}$ inch, inclusive, by thirty-seconds) in wood case.

Price with plug taps	\$7 70
Price with taper and plug taps	9 50
Price with taper, plug and bottoming taps	11 50

Set "C"

Contains stock, wrench and thirteen sizes of taps, dies and collets ($\frac{1}{16}$ to $\frac{1}{4}$ inch, inclusive, by sixty-fourths) in wood case.

Price with plug taps	\$12 00
Price with taper and plug taps	15 50
Price with taper, plug and bottoming taps	19 00

For list of style, threads and pitches that can be furnished, see table of No. 0 taps on page 11.

Also machine screw sizes from No. 2 to No. 14, inclusive, of all pitches found in the list of machine screw taps on page 15. When these taps are wanted with No. 0 stock, it should be so mentioned, that those with shanks squared to fit the wrench may be furnished.

Prices and weights of the parts are as follows :

	Weight, Ounces	Price
Stock ($5\frac{1}{8}$ inches long) with thumb-screw.....	2	\$0 50
Thumb-screw for stock		08
Screws for collets, each		02
Collet, including screws	$\frac{1}{2}$	35
Die ($\frac{1}{4}$ -inch thick by $\frac{5}{8}$ -inch outside diameter)	$\frac{1}{2}$	40
Taps (either taper, plug or bottoming).....		35
Wooden box.....	6	50
Case, velvet-lined (for regular set).....	5	70
Case, velvet-lined (for 7 dies and 21 taps) ...	12	90
Wrench		50

Dies with right- or left-hand thread for which hobs must be made will be furnished at \$1.75, net, for a single one, and 50 cents each, net, for additional dies.

Prices given above do not apply to square, double or any special form of thread. These will be given on application.

When this style die is ordered for use in a screw machine, it should be so stated.

British Association Standard



We are prepared to furnish die sets in accordance with the above standard as follows:

Set consists of dies and collets, and taper and plug taps Nos. 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10, one stock and one tap wrench.

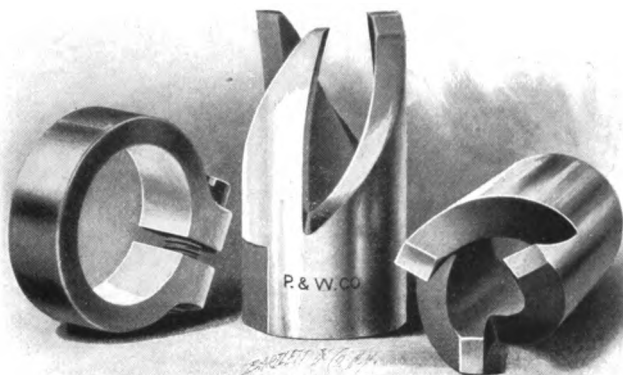
Price, complete, in hard-wood case..... \$15 00

Gauge plates for either thread or body sizes can be furnished.

Price of Parts

Die and collet, complete.....	\$1 00
Taps, each.....	50
Stock.....	50
Tap wrench.....	50
Gauge plates, thread or body size, each.....	2 50

Hollow Mills



These mills are often used on short cuts, immediately preceding threading dies, but on long, straight cuts, and especially on square stock, and in cutting large-headed screws from a bar, they should be followed by a box tool.

Diameter of Cut Inches	Outside Diameter Inches	Length Inches	Price Each	Price of Clamp Collar
$\frac{1}{8}$, $\frac{3}{8}$, $\frac{1}{4}$	$\frac{1}{2}$	$1\frac{1}{4}$	\$1 50	\$0 50
$\frac{1}{4}$, $\frac{5}{8}$, $\frac{3}{8}$	$\frac{3}{4}$	$1\frac{3}{4}$	1 75	60
$\frac{3}{8}$, $\frac{7}{8}$, $\frac{1}{2}$	1	2	2 00	70
$\frac{5}{8}$, $1\frac{1}{8}$, $\frac{3}{4}$	$1\frac{3}{8}$	$2\frac{1}{4}$	2 00	80
$\frac{3}{8}$, $\frac{7}{8}$, $\frac{1}{2}$, $1\frac{1}{8}$, $\frac{5}{8}$, $\frac{3}{4}$	$1\frac{1}{4}$	$2\frac{1}{2}$	2 00	80
$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$	$1\frac{3}{8}$	$2\frac{1}{2}$	2 40	1 00
$\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{8}$, 1	$1\frac{5}{8}$	$2\frac{1}{2}$	2 75	1 20
$\frac{3}{4}$, $\frac{7}{8}$, 1, $1\frac{1}{8}$, $1\frac{1}{4}$	2	3	3 50	1 50
1, $1\frac{1}{8}$, $1\frac{1}{4}$, $1\frac{3}{8}$, $1\frac{1}{2}$	$2\frac{1}{2}$	$3\frac{1}{2}$	5 00	2 50
$1\frac{3}{4}$, $1\frac{7}{8}$, 2, $2\frac{1}{8}$	$3\frac{1}{4}$	4	8 00	5 00

Spring Screw-threading Dies



This type of die is adjustable by means of a clamp collar. For uniform and well-finished threads, two dies should be used, one for roughing and one for finishing cut. Dies with U. S. Standard thread of sizes given in the table below are carried in stock. Special diameters, form and pitch of thread are furnished at special prices.

Machine Screw Sizes

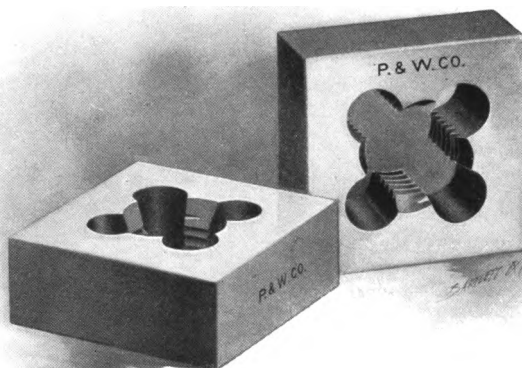
Size of Screw Gauge	Standard No. of Threads per Inch	Outside Diameter of Die Inches	Length of Die Inches	Price of Die	Price of Clamp Collar
2	56	$\frac{1}{2}$	$1\frac{1}{4}$	\$1 50	\$0 50
3	48	$\frac{1}{2}$	$1\frac{1}{4}$	1 50	50
4	36	$\frac{1}{2}$	$1\frac{1}{4}$	1 50	50
5	36	$\frac{1}{2}$	$1\frac{1}{4}$	1 50	50
6	32	$\frac{1}{2}$	$1\frac{1}{4}$	1 50	50
8	32	$\frac{1}{2}$	$1\frac{1}{4}$	1 50	50
8	32	$\frac{3}{4}$	$1\frac{3}{4}$	1 75	60
10	24	$\frac{3}{4}$	$1\frac{3}{4}$	1 75	60
12	24	$\frac{3}{4}$	$1\frac{3}{4}$	1 75	60
14	20	$\frac{3}{4}$	$1\frac{3}{4}$	1 75	60

Spring Screw-threading Dies

Fractional Sizes

Diam. of Cut Inches	Number of Threads to the Inch			Outside Diameter of Die Inches	Length of Die Inches	Price of Die	Price of Clamp Collar
	U. S. Std.	Whit- worth Std.	V Form				
1/8	40	40	..	1/2	1 1/4	\$1 50	\$0 50
3/16	32	24	24	1/2	1 1/4	1 50	50
1/4	20	20	20	1/2	1 1/4	1 50	50
5/16	20	20	20	3/4	1 3/4	1 75	60
3/8	18	18	18	3/4	1 3/4	1 75	60
7/16	16	16	16	3/4	1 3/4	1 75	60
1/2	16	16	16	1	2	2 00	70
5/8	14	14	14	1	2	2 00	70
3/4	13	12	12	1	2	2 00	70
7/8	11	11	11	1 3/16	2 1/4	2 00	80
1	11	11	11	1 3/16	2 1/4	2 00	80
1 1/8	10	10	10	1 3/16	2 1/4	2 00	80
1 1/4	16	16	16	1 1/4	2 1/2	2 00	80
1 1/2	14	14	14	1 1/4	2 1/2	2 00	80
1 3/4	13	12	12	1 1/4	2 1/2	2 00	80
2	12	12	12	1 1/4	2 1/2	2 00	80
2 1/8	11	11	11	1 1/4	2 1/2	2 00	80
2 1/4	10	10	10	1 1/4	2 1/2	2 00	80
2 1/2	13	12	12	1 3/8	2 1/2	2 40	1 00
2 3/4	12	12	12	1 3/8	2 1/2	2 40	1 00
3	11	11	11	1 3/8	2 1/2	2 40	1 00
3 1/8	10	10	10	1 3/8	2 1/2	2 40	1 00
3 1/4	11	11	11	1 5/8	2 1/2	2 75	1 20
3 1/2	10	10	10	1 5/8	2 1/2	2 75	1 20
3 3/4	9	9	9	1 5/8	2 1/2	2 75	1 20
4	8	8	8	1 5/8	2 1/2	2 75	1 20
4 1/8	10	10	10	2	3	3 50	1 50
4 1/4	9	9	9	2	3	3 50	1 50
4 1/2	8	8	8	2	3	3 50	1 50
4 3/4	7	7	7	2	3	3 50	1 50
5	7	7	7	2	3	3 50	1 50
5 1/8	8	8	8	2 1/2	3 1/2	8 00	2 50
5 1/4	7	7	7	2 1/2	3 1/2	8 00	2 50
5 1/2	7	7	7	2 1/2	3 1/2	8 00	2 50
5 3/4	6	6	6	2 1/2	3 1/2	8 00	2 50
6	6	6	6	2 1/2	3 1/2	8 00	2 50
6 1/8	5	5	5	3 1/4	4	12 00	5 00
6 1/4	5	4 1/2	4 1/2	3 1/4	4	12 00	5 00
6 1/2	4 1/2	4 1/2	4 1/2	3 1/4	4	12 00	5 00
6 3/4	4 1/2	4 1/2	4 1/2	3 1/4	4	12 00	5 00

Machine or Solid Bolt Dies



Cutting Size Inches	No. Threads per Inch U. S. S.	No. Threads per Inch V Form	Size of Square Inches	Thickness Inches	Price, Each
$\frac{1}{4}$	20	20	$2\frac{1}{2}$	$\frac{1}{2}$	\$1 80
$\frac{5}{16}$	18	18	$2\frac{1}{2}$	$\frac{1}{2}$	1 80
$\frac{3}{8}$	16	16	$2\frac{1}{2}$	$\frac{1}{2}$	1 80
$\frac{7}{16}$	14	14	$2\frac{1}{2}$	$\frac{1}{2}$	1 80
$\frac{1}{2}$	13	12	$2\frac{1}{2}$	$\frac{3}{4}$	1 80
$\frac{5}{8}$	11	11	$2\frac{1}{2}$	$\frac{3}{4}$	2 00
$\frac{3}{4}$	10	10	$2\frac{1}{2}$	$\frac{3}{4}$	2 20
$\frac{7}{8}$	9	9	$2\frac{1}{2}$	$\frac{3}{4}$	2 40
1	8	8	$2\frac{1}{2}$	1	2 70
$1\frac{1}{8}$	7	7	$2\frac{1}{2}$	1	3 00
$1\frac{1}{4}$	7	7	$2\frac{1}{2}$	1	3 30
$1\frac{3}{8}$	6	6	$2\frac{1}{2}$	1	3 60
$1\frac{1}{2}$	6	6	3	1	3 90
$1\frac{5}{8}$	$5\frac{1}{2}$	5	3	1	4 20
$1\frac{3}{4}$	5	5	3	$1\frac{1}{4}$	5 40
$1\frac{7}{8}$	5	$4\frac{1}{2}$	$3\frac{1}{2}$	$1\frac{1}{2}$	6 50
2	$4\frac{1}{2}$	$4\frac{1}{2}$	$3\frac{3}{4}$	2	7 50

All orders for solid bolt dies will be filled with U. S. S. threads unless otherwise specified.

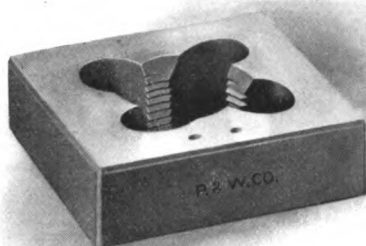
Dies $\frac{1}{4}$ -inch over size, $\frac{1}{4}$ to $\frac{5}{8}$ -inch, inclusive, and $\frac{1}{2}$ -inch over size, $\frac{1}{4}$ to 2 inches, inclusive, furnished at regular prices.

Orders for special sizes must be accompanied by sample or full specifications.

Left-hand dies are special and prices will be quoted on application.

Solid Square Pipe Dies

Briggs Standard

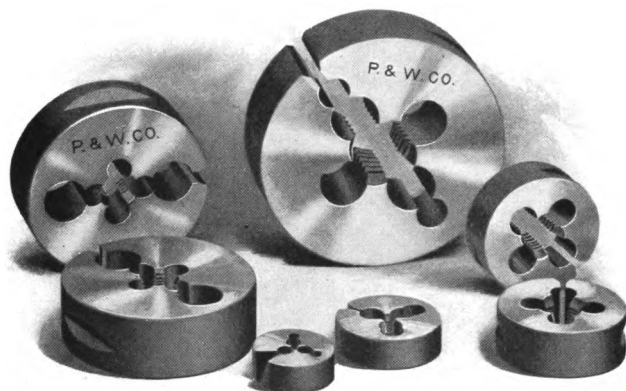


Dimensions and Prices

Cutting Size	Size of Die, Inches		Price Each	Cutting Size	Size of Die, Inches		Price Each
	Square	Thick- ness			Square	Thick- ness	
$\frac{1}{8}$	2	$\frac{1}{2}$	\$1 50		$2\frac{7}{8}$	$\frac{3}{4}$	\$2 50
	2	$\frac{1}{2}$	1 50		3	$\frac{3}{4}$	2 50
$\frac{1}{4}$	$2\frac{3}{8}$	$\frac{3}{4}$	2 00	$1\frac{1}{4}$	$3\frac{7}{8}$	$\frac{7}{8}$	3 50
	$2\frac{1}{2}$	$\frac{3}{4}$	2 00		$3\frac{7}{8}$	1	3 50
	2	$\frac{1}{2}$	1 50		4	$\frac{7}{8}$	3 50
$\frac{3}{8}$	$2\frac{3}{8}$	$\frac{3}{4}$	2 00		4	1	3 50
	$2\frac{1}{2}$	$\frac{3}{4}$	2 00		$3\frac{7}{8}$	$\frac{7}{8}$	3 50
	2	$\frac{1}{2}$	1 50	$1\frac{1}{2}$	$3\frac{7}{8}$	1	3 50
$\frac{1}{2}$	$2\frac{3}{8}$	$\frac{3}{4}$	2 00		4	$\frac{7}{8}$	3 50
	$2\frac{1}{2}$	$\frac{3}{4}$	2 00		4	1	3 50
	$2\frac{3}{8}$	$\frac{3}{4}$	2 00		$3\frac{7}{8}$	$\frac{7}{8}$	3 50
$\frac{3}{4}$	$2\frac{1}{2}$	$\frac{3}{4}$	2 00	2	$3\frac{7}{8}$	1	3 50
	$2\frac{7}{8}$	$\frac{3}{4}$	2 50		4	$\frac{7}{8}$	3 50
	3	$\frac{3}{4}$	2 50		4	1	3 50
	$2\frac{3}{8}$	$\frac{3}{4}$	2 00	$2\frac{1}{2}$	5	$1\frac{1}{4}$	9 00
	$2\frac{1}{2}$	$\frac{3}{4}$	2 00		5	$1\frac{1}{4}$	9 00
1	$2\frac{7}{8}$	$\frac{3}{4}$	2 50				
	3	$\frac{3}{4}$	2 50				

Pipe dies are furnished either right- or left-hand at same prices.

Adjustable Round Split Dies



Outside Diameter $\frac{5}{8}$ -inch, $\frac{1}{4}$ -inch Thick
Machine Screw Sizes

Size of Screw Gauge	Standard No. of Threads per Inch	Threads per Inch also Furnished	Price Each
No. 1		56, 60, 64, 72	\$0 40
1½		56	40
2	56	48, 64	40
3	48	40, 56	40
4	36	32, 40, 42, 48	40
5	36	32, 40	40
6	32	30, 36, 38, 40, 48	40
7	32	30, 40	40
8	32	30, 36, 40	40
9	30	28, 32	40
10	24	28, 30, 32, 36	40
11	24	28, 30	40
12	24	20, 32	40
13	22	20, 24, 32	40
14	20	18, 24	40

Order by numbers, stating outside diameter and thickness of die, number of threads per inch, and form of thread. Fractional sizes are also carried in stock, from $\frac{1}{16}$ -inch to $\frac{1}{4}$ -inch, in U. S., Whitworth and V forms of thread, as per No. 0 Hand Tap list on page 11.

Special sizes with right- or left-hand thread, for which hobs must be made, will be furnished at \$1.75, net, for a single one, and at 50 cents each, net, for additional dies.

For lathe die-holders taking these dies, see page 65.

Adjustable Round Split Dies

Outside Diameter $\frac{1}{8}$ -inch, $\frac{1}{4}$ -inch Thick

Machine Screw Sizes

Size of Screw Gauge	Standard No. of Threads per Inch	Threads per Inch also Furnished	Price Each
No. 1		56, 60, 64, 72	\$0 50
1½		56	50
2	56	48, 64	50
3	48	40, 56	50
4	36	32, 40, 42, 48	50
5	36	32, 40	50
6	32	30, 36, 38, 40, 48	50
7	32	30, 40	50
8	32	30, 36, 40	50
9	30	28, 32	50
10	24	28, 30, 32, 36	50
11	24	28, 30	50
12	24	20, 32	50
13	22	20, 24, 32	50
14	20	18, 24	50
15	20	18, 24	50
16	18	16, 20	50

Order by number, stating outside diameter and thickness of die, number of threads per inch, and form of thread. Fractional sizes are also carried in stock, from $\frac{1}{16}$ -inch to $\frac{5}{16}$ -inch, in U. S., Whitworth, and V forms of thread, as per No. 0 and Machinists' Hand Tap lists on pages 11 and 13.

Special sizes with right- or left-hand thread, for which hobs must be made, will be furnished at \$1.75, net, for a single one, and 50 cents each, net, for additional dies.

For lathe die-holders taking these dies, see page 65.

Adjustable Round Split Dies

Outside Diameter 1-inch, $\frac{3}{8}$ -inch Thick

Machine Screw Sizes

Size of Screw Gauge	Standard No. of Threads per Inch	Threads per Inch also Furnished	Price Each
No. 10	24	28, 30, 32, 36	\$0 75
11	24	28, 30	75
12	24	20, 32	75
13	22	20, 24, 32	75
14	20	18, 24	75
15	20	18, 24	75
16	18	16, 20	75
18	18	16, 20	75
20	16	18	75
22	16	18	75
24	16	14, 18	75
26	16	14	75
28	14	16	75
30	14	16	75

Order by number, stating outside diameter and thickness of die, number of threads per inch, and form of thread. Fractional sizes are also carried in stock, from $\frac{3}{16}$ -inch to $\frac{1}{2}$ -inch, in U. S., Whitworth, and V forms of thread, as per Machinists' Hand Tap list on page 13.

Special sizes with right- or left-hand thread, for which hobs must be made, will be furnished at \$2.50, net, for a single one, and at 75 cents each, net, for additional dies.

For lathe die-holders taking these dies, see page 65.

Adjustable Round Split Dies

U. S. S., Whitworth Standard, or V Form

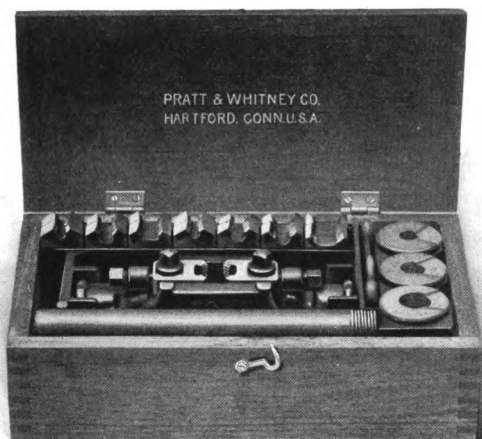
Size of Die		Cutting Size Inches	Number of Threads to the Inch				Price Each
Diam. Inches	Thick- ness Inches		U. S. Std.	Whit- worth Std.	V Form	Other V Threads also Furnished	
1½	½	¼	20	20	20	24, 27, 32	\$1 00
1½	½	⅝	18	18	18	20, 24, 27, 32	1 00
1½	½	⅞	16	16	16	14, 18, 20, 24, 27	1 00
1½	½	1⅞	14	14	14	12, 16, 20, 24, 27	1 00
1½	½	½	13	12	12	13, 14, 16, 20, 24, 27	1 00
1½	½	⅝	11	11	11	10, 12, 20, 24, 27	1 00
2	⅝	⅝	16	16	16	14, 18, 20, 24, 27	1 25
2	⅝	1⅞	14	14	14	12, 16, 20, 24, 27	1 25
2	⅝	½	13	12	12	13, 14, 16, 20, 24, 27	1 25
2	⅝	⅝	11	11	11	10, 12, 20, 24, 27	1 25
2	⅝	¾	10	10	10	12, 20, 27	1 25
2	⅝	⅞	9	9	9	10, 12, 27	1 25
2½	1⅞	½	13	12	12	13, 14, 16, 20, 24, 27	1 50
2½	1⅞	⅝	11	11	11	10, 12, 20, 24, 27	1 75
2½	1⅞	¾	10	10	10	12, 20, 27	2 00
2½	1⅞	⅞	9	9	9	10, 12, 27	2 25
2½	1⅞	1	8	8	8	12, 27	2 50
2½	1⅞	1⅞	7	7	7	8, 12	2 50
2½	1⅞	1¼	7	7	7	12	2 50

Dies cutting ½ inch with 12 threads per inch, U. S. form of thread, will be furnished at regular list and discount.

Dies of special diameter or thread other than noted above will be furnished to order at special rates.

For lathe die-holders taking these dies, see page 65.

Armstrong's Adjustable Stock and Pipe Dies



The Armstrong dies have a double-taper, that is, the taper at the entrance for the first few threads is greater in degree than the standard taper, which forms a lead to the dies, causing them to start on the pipe without filing, even when there is a swell or burr, and requiring no pressure to start the dies on the pipe.

They can be sharpened by grinding without drawing the temper.

They are interchangeable in the stock, and although adjustable, are adjusted only when the irregularity or variations in the fittings make it necessary. There are corresponding marks ($\frac{1}{8}$) on the stock and on the dies ($\frac{8}{1}$), and when these marks are brought into line the dies will cut the standard size.

Prices

No. 1 stock, with four right or left pipe dies, $\frac{1}{8}$ to $\frac{1}{2}$, and four bushings in box; weight, $6\frac{1}{2}$ pounds.....	\$9 00
No. 1 stock, with four each right and left pipe dies, $\frac{1}{8}$ to $\frac{1}{2}$, and bushings in box; weight, $7\frac{1}{2}$ pounds.....	14 00
Price of parts for No. 1 set:	
Stock.....	3 25
Pipe bushings, each.....	20
Wrench.....	25
Pipe dies, right or left; weight, 2 ounces, each.....	1 25

Prices

Price of parts for No. 1 set—continued:

Collar screw.....	\$0 12
Adjusting screw.....	10
Thumb-screw.....	10
No. 2 stock, with five pipe dies, right or left, $\frac{1}{4}$ to 1 inch, and five bushings in box; weight, 19 pounds.....	12 00
No. 2 stock, with five each right and left pipe dies, $\frac{1}{4}$ to 1 inch, and bushings in box; weight, 22½ pounds.....	20 00
Price of parts for No. 2 set:	
Stock.....	4 00
Long guide, with thumb-screw, each.....	50
Pipe dies, right or left; weight, 6 ounces; each.....	1 50
Bushings, each.....	25
Wrench.....	25
Collar screw.....	12
Adjusting screw.....	10
Thumb-screw.....	10
$\frac{1}{4}$ -inch dies and bushings for No. 2.....	1 75
Stock and any number of dies or parts furnished at above prices.	
No. 2½ stock, with four dies, cutting $\frac{1}{2}$, $\frac{3}{4}$, 1 and 1¼ inches, right-hand, and four bushings in box; weight, 19½ pounds.....	12 00
No. 2½ stock, with four each right and left dies, $\frac{1}{2}$ to 1¼ inches, and four bushings in box; weight, 22 pounds..	18 00
Price of parts for No. 2½ set:	
Stock.....	4 50
Bushings, each.....	40
Wrench.....	25
*Dies, right or left, cutting $\frac{1}{2}$ to $\frac{3}{4}$, each.....	3 25
*Dies, right or left, cutting 1 to 1¼, each.....	3 25
Collar screw.....	15
Adjusting screw.....	15
Thumb-screw.....	10
No. 3 stock, with four dies, 1 to 2 inches, right or left, four bushings in box; weight, 41 pounds.....	24 00
Price of parts for No. 3 set:	
Stock.....	7 00
Bushings, each.....	50
Wrenches, each.....	50
Collar screws, each.....	15
Adjusting screw.....	15
Thumb-screw.....	15
Dies, right or left; weight, 17 to 22 ounces; each.....	4 00
No. 6 stock, with dies cutting 2½ and 3-inch pipe, and bush- ings in box; weight, 77 pounds.....	40 00
Price of parts for No. 6 set:	
Stock, without dies.....	25 00
Bushings, each.....	1 00
*Dies, cutting 2½ to 3 inches; weight, 50 ounces; each..	15 00
Wrenches, steel forged.....	50
Collar screw.....	25
Adjusting screw.....	20

*The change from $\frac{1}{2}$ to $\frac{3}{4}$, 1 to 1¼, and 2½ to 3 inches is made by simply reversing the dies end for end, when they will cut to standard sizes without further adjustment.

Bit-brace Taps, Dies and Collets

U. S. S., Whitworth Standard, and V Form



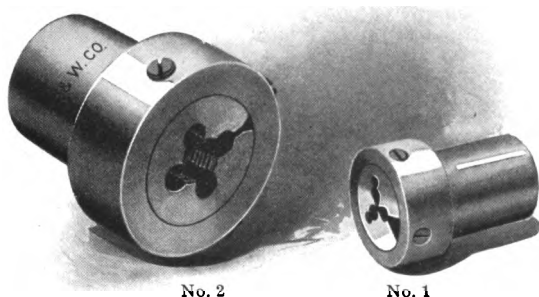
Prices and Sizes

Cutting Size Inches	Number of Threads to the Inch				Out'de Diam. of Die Inches	Thick- ness of Die Inches	Len'th of Tap Inches	Price of Dies Each	Price of Taps Each
	U. S. Std.	Whit- worth Std.	V Form	Other V Threads also Furnished					
$\frac{3}{16}$	32	24	24	30, 32, 36	1	$\frac{3}{8}$	$3\frac{1}{4}$	\$0 75	\$0 50
$\frac{1}{4}$	20	20	20	24, 27, 32	1	$\frac{3}{8}$	$3\frac{1}{4}$	75	50
$\frac{5}{16}$	18	18	18	20, 24, 27, 32	1	$\frac{3}{8}$	$3\frac{3}{8}$	75	55
$\frac{3}{8}$	16	16	16	14, 18, 20, 24, 27	1	$\frac{3}{8}$	$3\frac{3}{8}$	75	60
$\frac{7}{16}$	14	14	14	12, 16, 20, 24, 27	1	$\frac{3}{8}$	$3\frac{3}{8}$	75	70
$\frac{1}{2}$	13	12	12	13, 14, 16, 20, 24, 27	1	$\frac{3}{8}$	$3\frac{3}{8}$	75	80

Price of collet for above dies, 75 cents.

Shanks of taps and collets are $\frac{1}{8} \times \frac{7}{16} \times 1 \frac{3}{8}$ inches.

Die-holders for Use in an Ordinary Lathe



Prices

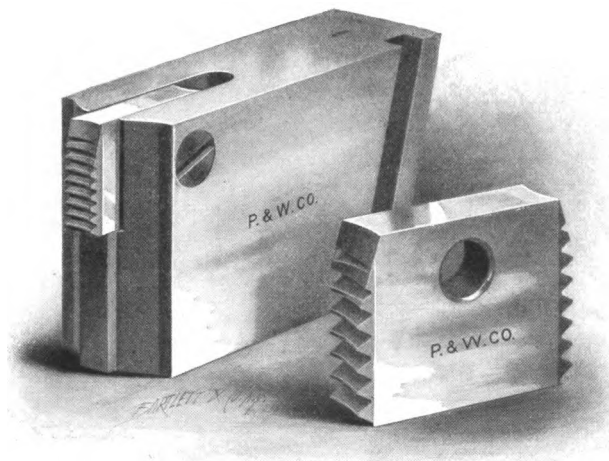
No. 1 die-holder for dies $\frac{3}{8}$ -inch outside diameter.....	\$0 75
No. 2 die-holder for dies $\frac{1}{2}$ -inch outside diameter.....	1 00
No. 3 die-holder for dies 1-inch outside diameter.....	1 00
No. 4 die-holder for dies $1\frac{1}{2}$ inches outside diameter.....	1 50
No. 5 die-holder for dies 2 inches outside diameter.....	2 50
No. 6 die-holder for dies $2\frac{1}{2}$ inches outside diameter.....	3 50

For list of dies that can be used in these holders, see pages 51, 58, 59, 60 and 61.

Cases and Chasers for National Bolt-cutter

Price List of Cases

	Per Set
Cases for No. 2 Machine.....	\$1 60
Cases for No. 3 Machine.....	2 10
Cases for No. 4 Machine.....	4 25
Cases for No. 5 Machine.....	4 25
Cases for No. 6 Machine.....	6 50
Cases for No. 7 Machine.....	6 50



Double-end Chasers for National Bolt-cutter

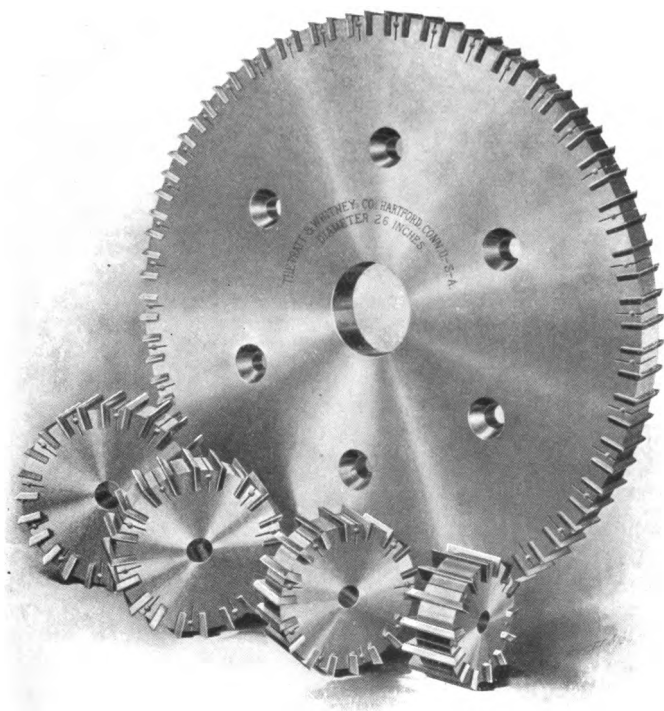
Per Set of Four

$\frac{3}{8}$ to 1 -inch, U. S. S.....	\$2 50
$1\frac{1}{8}$ to $1\frac{1}{2}$ -inch, U. S. S.....	2 60
$1\frac{5}{8}$ to $2\frac{1}{2}$ -inch, U. S. S.....	3 50
$2\frac{3}{8}$ to $3\frac{1}{2}$ -inch, U. S. S.....	4 75

Double-end chasers are regularly furnished tempered ready for use.

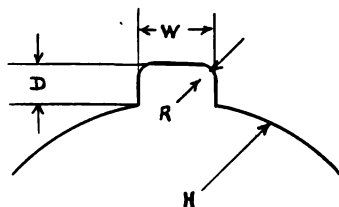
If the condition of the machine is such as to render it necessary to re-hob them in the die-head, we will furnish the chasers annealed for this purpose, when so ordered.

Milling Cutter Section



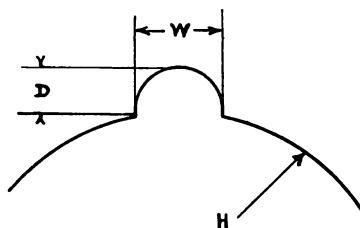
Keyways for Milling Cutters

Milling Cutters Furnished with Either Type as Desired



Square Keyway

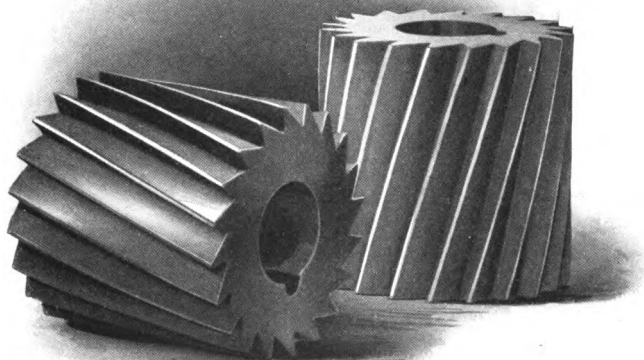
Size Hole, H	$\frac{3}{8}$ - $\frac{9}{16}$	$\frac{5}{8}$ - $\frac{7}{8}$	$1\frac{1}{8}$ - $1\frac{1}{4}$	$1\frac{3}{8}$ - $1\frac{1}{2}$	$1\frac{7}{8}$ - 2	$2\frac{1}{8}$ - $2\frac{1}{2}$	$2\frac{3}{4}$ - 3
Width Key, W	$\frac{3}{32}$	$\frac{1}{8}$	$\frac{5}{32}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{7}{16}$
Depth, D	$\frac{3}{64}$	$\frac{1}{16}$	$\frac{5}{64}$	$\frac{3}{32}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$
Radius, R	.020	.030	.035	.040	.050	.060	.060



Half-round Keyway

Size Hole, H	$\frac{3}{8}$ - $\frac{5}{8}$	$1\frac{1}{8}$ - $1\frac{3}{8}$	$1\frac{1}{2}$ - 2	$2\frac{1}{8}$ - $2\frac{3}{8}$	$2\frac{1}{2}$ - 3
Width, W	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$
Depth, D	$\frac{1}{16}$	$\frac{3}{32}$	$\frac{1}{8}$	$\frac{5}{32}$	$\frac{3}{16}$

Plain Milling Cutters



Square or Half-round Keyway

Cutters of $\frac{3}{4}$ -inch face and over have teeth of a spiral form.
Cutters varying from the following list are made to order of any required size.

Diam. Cutter Inches	Width Face Inches	Size Hole Inches	Price Each	Diam. Cutter Inches	Width Face Inches	Size Hole Inches	Price Each
$2\frac{1}{4}$	$\frac{3}{8}$	$\frac{7}{8}$	\$1 30	$2\frac{1}{2}$	$1\frac{3}{8}$	1	\$2 30
$2\frac{1}{4}$	$\frac{1}{2}$	$\frac{7}{8}$	1 75	$2\frac{1}{2}$	$\frac{7}{8}$	1	2 40
$2\frac{1}{4}$	1	$\frac{7}{8}$	2 50	$2\frac{1}{2}$	1	1	2 60
$2\frac{1}{4}$	$1\frac{3}{4}$	$\frac{7}{8}$	3 30	$2\frac{1}{2}$	$1\frac{1}{8}$	1	2 75
$2\frac{1}{2}$	$\frac{3}{8}$	1	1 30	$2\frac{1}{2}$	$1\frac{1}{4}$	1	2 90
$2\frac{1}{2}$	$\frac{1}{4}$	1	1 40	$2\frac{1}{2}$	$1\frac{1}{2}$	1	3 10
$2\frac{1}{2}$	$\frac{5}{8}$	1	1 50	$2\frac{1}{2}$	$1\frac{3}{4}$	1	3 40
$2\frac{1}{2}$	$\frac{3}{8}$	1	1 60	$2\frac{1}{2}$	2	1	3 70
$2\frac{1}{2}$	$\frac{7}{8}$	1	1 70	$2\frac{1}{2}$	$2\frac{1}{4}$	1	3 90
$2\frac{1}{2}$	$\frac{1}{2}$	1	1 80	$2\frac{1}{2}$	$2\frac{1}{2}$	1	4 10
$2\frac{1}{2}$	$\frac{9}{8}$	1	1 90	$2\frac{1}{2}$	$2\frac{3}{4}$	1	4 25
$2\frac{1}{2}$	$\frac{5}{8}$	1	2 00	$2\frac{1}{2}$	3	1	4 50
$2\frac{1}{2}$	$1\frac{1}{8}$	1	2 10	$2\frac{1}{2}$	$3\frac{1}{2}$	1	5 00
$2\frac{1}{2}$	$\frac{3}{4}$	1	2 20	$2\frac{1}{2}$	4	1	5 50

Plain Milling Cutters—Continued

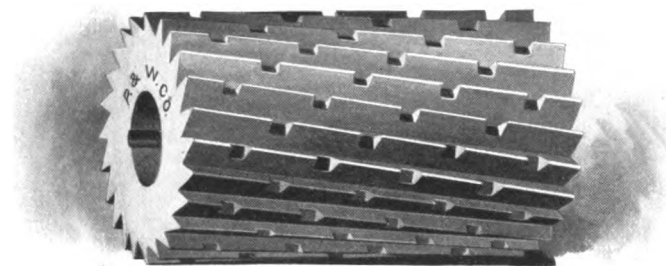
Diam. Cutter Inches	Width Face Inches	Size Hole Inches	Price Each	Diam. Cutter Inches	Width Face Inches	Size Hole Inches	Price Each
2 3/4	3/16	1	\$1 30	3	3/4	1 1/4	\$3 00
2 3/4	1/4	1	1 50	3	7/8	1 1/4	3 30
2 3/4	5/16	1	1 60	3	1	1 1/4	3 60
2 3/4	3/8	1	1 80	3	1 1/4	1 1/4	4 00
2 3/4	7/16	1	1 85	3	1 1/2	1 1/4	4 30
2 3/4	1/2	1	1 90	3	1 3/4	1 1/4	4 50
2 3/4	9/16	1	2 00	3	2	1 1/4	4 70
2 3/4	5/8	1	2 10	3	2 1/2	1 1/4	5 20
2 3/4	11/16	1	2 30	3	3	1 1/4	5 40
2 3/4	3/4	1	2 50	3	3 1/2	1 1/4	5 90
2 3/4	7/8	1	2 85	3	4	1 1/4	6 40
2 3/4	1	1	3 10	3	5	1 1/4	7 80
2 3/4	1 1/8	1	3 25	3	6	1 1/4	10 80
2 3/4	1 1/4	1	3 40	3 1/2	3/16	1	1 45
2 3/4	1 1/2	1	3 75	3 1/2	1/4	1	1 70
2 3/4	1 3/4	1	4 00	3 1/2	5/16	1	2 05
2 3/4	2	1	4 20	3 1/2	3/8	1	2 40
2 3/4	2 1/2	1	4 60	3 1/2	7/16	1	2 75
2 3/4	3	1	5 00	3 1/2	1/2	1 1/4	3 15
2 3/4	3 1/2	1	5 50	3 1/2	9/16	1 1/4	3 30
2 3/4	4	1 1/4	6 00	3 1/2	5/8	1 1/4	3 45
2 3/4	5	1 1/4	7 40	3 1/2	11/16	1 1/4	3 65
2 3/4	6	1 1/4	10 00	3 1/2	3/4	1 1/4	3 85
3	3/16	1	1 35	3 1/2	7/8	1 1/4	4 35
3	1/4	1	1 60	3 1/2	1	1 1/4	4 75
3	5/16	1	1 85	3 1/2	1 1/4	1 1/4	5 15
3	3/8	1 1/4	2 10	3 1/2	1 1/2	1 1/4	5 60
3	7/16	1 1/4	2 25	3 1/2	1 3/4	1 1/4	6 00
3	1/2	1 1/4	2 40	3 1/2	2	1 1/4	6 40
3	9/16	1 1/4	2 55	3 1/2	2 1/2	1 1/4	6 90
3	5/8	1 1/4	2 70	3 1/2	3	1 1/4	7 40
3	11/16	1 1/4	2 85	3 1/2	3 1/2	1 1/4	8 15

Plain Milling Cutters—Continued

Diam. Cutter Inches	Width Face Inches	Size Hole Inches	Price Each	Diam. Cutter Inches	Width Face Inches	Size Hole Inches	Price Each
3½	4	1¼	\$9 15	4	4	1¼	\$11 00
3½	5	1¼	10 40	4	4	1½	11 00
3½	6	1¼	11 90	4	5	1¼	13 50
4	¼	1	2 00	4	5	1½	13 50
4	¼	1¼	2 00	4	6	1¼	15 50
4	$\frac{5}{16}$	1	2 50	4	6	1½	15 50
4	$\frac{5}{16}$	1¼	2 50	4½	$\frac{3}{8}$	1¾	3 35
4	$\frac{3}{8}$	1	3 00	4½	$\frac{3}{8}$	2	3 35
4	$\frac{3}{8}$	1¼	3 00	4½	$\frac{7}{16}$	1¾	3 75
4	$\frac{7}{16}$	1¼	3 50	4½	$\frac{7}{16}$	2	3 75
4	½	1¼	3 90	4½	½	1¾	4 10
4	½	1½	3 90	4½	½	2	4 10
4	$\frac{9}{16}$	1¼	4 10	4½	$\frac{9}{16}$	1¾	4 40
4	$\frac{5}{8}$	1¼	4 30	4½	$\frac{9}{16}$	2	4 40
4	$\frac{11}{16}$	1¼	4 50	4½	$\frac{5}{8}$	1¾	4 60
4	$\frac{3}{4}$	1¼	4 70	4½	$\frac{5}{8}$	2	4 60
4	$\frac{3}{4}$	1½	4 70	4½	$\frac{11}{16}$	1¾	4 85
4	$\frac{7}{8}$	1¼	5 15	4½	$\frac{11}{16}$	2	4 85
4	1	1¼	5 65	4½	$\frac{3}{4}$	1¾	5 10
4	1	1½	5 65	4½	$\frac{3}{4}$	2	5 10
4	1¼	1¼	6 25	4½	$\frac{7}{8}$	1¾	5 50
4	1¼	1½	6 25	4½	$\frac{7}{8}$	2	5 50
4	1½	1¼	6 65	4½	1	1¾	6 00
4	1½	1½	6 65	4½	1	2	6 00
4	1¾	1¼	7 05	4½	1¼	1¾	6 60
4	1¾	1½	7 05	4½	1¼	2	6 60
4	2	1¼	7 45	4½	1½	1¾	7 25
4	2	1½	7 45	4½	1½	2	7 25
4	2½	1¼	8 40	4½	1¾	1¾	8 00
4	3	1¼	9 00	4½	1¾	2	8 00
4	3	1½	9 00	4½	2	1¾	8 75
4	3½	1¼	10 00	4½	2	2	8 75

Milling Cutters

With Nicked Cutting Edges



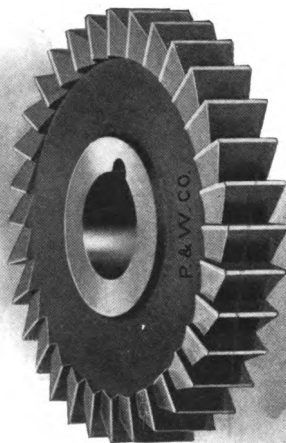
Square or Half-round Keyway—Price List

Diameter Inches	Width of Face Inches	Size of Hole Inches	Price Each	Diameter Inches	Width of Face Inches	Size of Hole Inches	Price Each
2½	2½	1	\$4 90	4	3½	1¼	\$12 00
2½	3	1	5 40	4	3½	1½	12 00
2½	3½	1	6 00	4	4	1¼	13 20
2½	4	1	6 60	4	4	1½	13 20
3	2½	1¼	6 25	4	5	1¼	16 20
3	3	1¼	6 50	4	5	1½	16 20
3	3½	1¼	7 10	4	6	1¼	18 60
3	4	1¼	7 70	4	6	1½	18 60
3	5	1¼	9 40	4½	2½	1¾	11 50
3	6	1¼	13 00	4½	2½	2	11 50
3½	2½	1¼	8 25	4½	3	1¾	12 75
3½	3	1¼	8 90	4½	3	2	12 75
3½	3½	1¼	9 80	4½	3½	1¾	14 25
3½	4	1¼	11 00	4½	3½	2	14 25
3½	5	1¼	12 50	4½	4	1¾	15 75
3½	6	1¼	14 25	4½	4	2	15 75
4	2½	1¼	10 00	4½	5	1¾	18 75
4	2½	1½	10 00	4½	5	2	18 75
4	3	1¼	10 80	4½	6	1¾	22 25
4	3	1½	10 80	4½	6	2	22 25

Side or Straddle Milling Cutters

Having teeth on face and sides, they are suitable for milling the sides of nuts, bolt heads and similar work.

Keyways of mills are regularly made of circular cross section, which weakens the mill less than the rectangular form, and can be more easily fitted with a key—a round wire being used for this purpose.

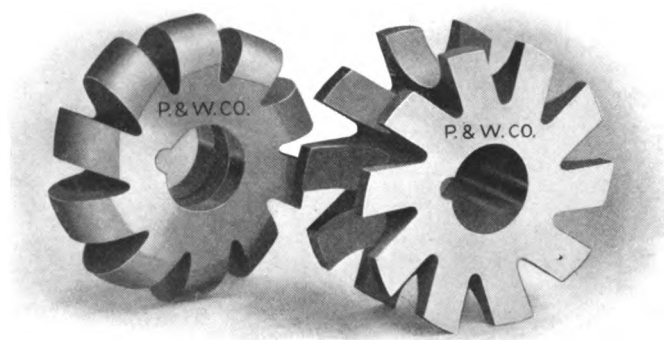


Square or Half-round Keyway—Price List

Diameter Inches	Width Face Inches	Size Hole Inches	Price Each	Diameter Inches	Width Face Inches	Size Hole Inches	Price Each
2	$\frac{3}{16}$	$\frac{1}{2}$	\$2 00	3½	$\frac{9}{16}$	1	\$3 50
2	$\frac{1}{4}$	$\frac{1}{2}$	2 05	3½	$\frac{5}{8}$	1	3 70
2	$\frac{3}{8}$	$\frac{1}{2}$	2 10	4	$\frac{1}{2}$	1	4 00
2	$\frac{3}{8}$	$\frac{5}{8}$	2 00	4	$\frac{5}{8}$	1	4 70
2	$\frac{1}{4}$	$\frac{3}{8}$	2 05	4	$\frac{3}{8}$	$\frac{7}{8}$	4 70
2	$\frac{3}{8}$	$\frac{5}{8}$	2 10	4	$\frac{5}{8}$	$1\frac{1}{4}$	4 70
2½	$\frac{1}{4}$	$\frac{7}{8}$	2 15	4	$\frac{3}{4}$	1	5 00
2½	$\frac{5}{16}$	$\frac{7}{8}$	2 20	4	$\frac{7}{8}$	1	5 50
2½	$\frac{3}{8}$	$\frac{7}{8}$	2 20	5	$\frac{3}{4}$	1	6 00
2½	$\frac{7}{16}$	$\frac{7}{8}$	2 25	5	$\frac{3}{4}$	$1\frac{1}{4}$	6 00
2½	$\frac{1}{2}$	$\frac{7}{8}$	2 25	5	$\frac{7}{8}$	1	6 50
2¾	$\frac{1}{4}$	$\frac{7}{8}$	2 30	5	1	1	7 25
2¾	$\frac{5}{16}$	$\frac{7}{8}$	2 30	6	$\frac{3}{4}$	1	7 60
2¾	$\frac{3}{8}$	$\frac{7}{8}$	2 30	6	$\frac{13}{16}$	$1\frac{1}{4}$	8 50
2¾	$\frac{7}{16}$	$\frac{7}{8}$	2 35	6	$\frac{13}{16}$	$1\frac{1}{2}$	8 50
2¾	$\frac{1}{2}$	$\frac{7}{8}$	2 35	6	1	1	9 50
3	$\frac{1}{4}$	1	2 40	7	1	$1\frac{1}{4}$	16 10
3	$\frac{5}{16}$	1	2 45	7	$1\frac{1}{8}$	$1\frac{1}{4}$	17 00
3	$\frac{3}{8}$	1	2 50	8	1	$1\frac{1}{4}$	19 60
3	$\frac{7}{16}$	1	2 65	8	$1\frac{3}{8}$	$1\frac{1}{4}$	23 00
3	$\frac{1}{2}$	1	2 80	8	$1\frac{3}{8}$	$1\frac{1}{2}$	23 00
3½	$\frac{7}{16}$	1	3 50	8	$1\frac{3}{8}$	$1\frac{3}{4}$	23 00
3½	$\frac{1}{2}$	1	3 50	8	$1\frac{3}{8}$	2	23 00

Cutters varying from the above list are made to order.

Cutters for Concave and Convex Milling

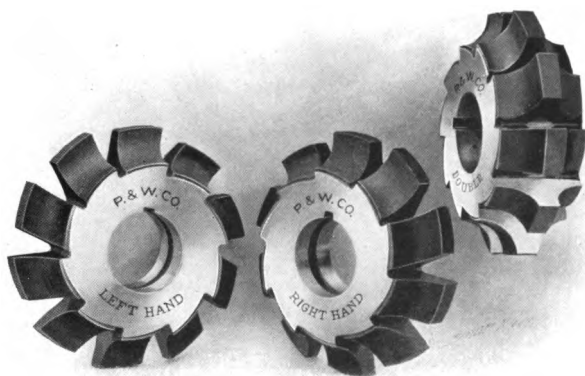


Square or Half-round Keyway

These cutters can be sharpened by grinding without changing their outline.

Diameter of Circle, Inches	Diameter of Cutter, Inches	Size of Hole Inches	Price of Convex Cutters Each	Price of Concave Cutters Each
$\frac{1}{8}$	2	$\frac{7}{8}$ and 1	\$2 00	\$2 40
$\frac{3}{16}$	2	$\frac{7}{8}$ " 1	2 25	2 70
$\frac{1}{4}$	2	$\frac{7}{8}$ " 1	2 50	3 00
$\frac{5}{16}$	$2\frac{1}{4}$	$\frac{7}{8}$ " 1	2 80	3 35
$\frac{3}{8}$	$2\frac{1}{4}$	$\frac{7}{8}$ " 1	3 10	3 70
$\frac{7}{16}$	$2\frac{1}{4}$	$\frac{7}{8}$ " 1	3 35	4 00
$\frac{1}{2}$	$2\frac{1}{4}$	$\frac{7}{8}$ " 1	3 60	4 30
$\frac{5}{8}$	$2\frac{3}{4}$	1	4 00	4 80
$\frac{3}{4}$	3	1	4 40	5 25
$\frac{7}{8}$	$3\frac{1}{4}$	1	4 80	5 75
1	$3\frac{1}{4}$	1	5 25	6 30
$1\frac{1}{8}$	$3\frac{1}{2}$	1	5 75	6 90
$1\frac{1}{4}$	$3\frac{1}{2}$	1	6 25	7 50
$1\frac{3}{8}$	$3\frac{3}{4}$	1	7 00	8 40
$1\frac{1}{2}$	$3\frac{3}{4}$	1	7 75	9 30

Corner-rounding Cutters



Square or Half-round Keyway

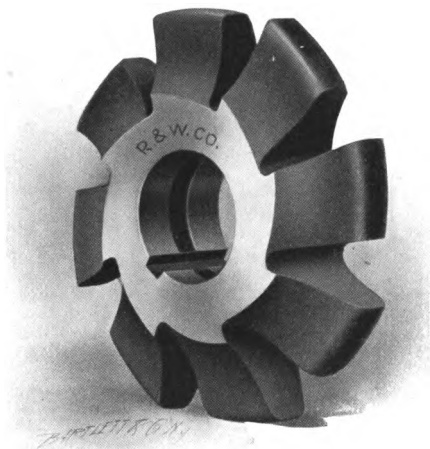
These cutters have side as well as radial clearance, and can be ground without changing their outline.

In ordering single cutters, state whether right- or left-hand are wanted.

Radius of Circle Inches	Diameter of Cutter Inches	Size of Hole Inches	Price of Single Cutters Each	Price of Double Cutters Each
$\frac{1}{16}$	2	$\frac{7}{8}$	\$2 00	\$2 40
$\frac{3}{32}$	2	$\frac{7}{8}$	2 25	2 70
$\frac{1}{8}$	2	$\frac{7}{8}$	2 50	3 00
$\frac{5}{32}$	$2\frac{1}{4}$	$\frac{7}{8}$	2 70	3 35
$\frac{3}{16}$	$2\frac{1}{4}$	$\frac{7}{8}$	2 90	3 70
$\frac{7}{32}$	$2\frac{1}{4}$	$\frac{7}{8}$	3 10	4 00
$\frac{1}{4}$	$2\frac{1}{4}$	$\frac{7}{8}$	3 30	4 30
$\frac{5}{16}$	$2\frac{3}{4}$	1	3 50	4 80
$\frac{3}{8}$	3	1	3 70	5 25
$\frac{7}{16}$	$3\frac{1}{4}$	1	3 90	5 75
$\frac{1}{2}$	$3\frac{1}{4}$	1	4 20	6 30
$\frac{9}{16}$	$3\frac{1}{2}$	1	4 50	6 90
$\frac{5}{8}$	$3\frac{1}{2}$	1	5 00	7 50
$\frac{11}{16}$	$3\frac{3}{4}$	1	5 75	8 40
$\frac{3}{4}$	$3\frac{3}{4}$	1	6 50	9 30

Involute Cutters

For Teeth of Gear Wheels



Each cutter is marked with its number, also the diametral pitch and number of teeth for which it is adapted.

All gears of same pitch cut with these cutters will interchange.

Cutters can be sharpened without changing their form.

Eight cutters are made for each pitch, as follows:

No. 1	will cut wheels from 135 teeth to a rack.
No. 2	" " " 55 " " 134 teeth.
No. 3	" " " 35 " " 54 "
No. 4	" " " 26 " " 34 "
No. 5	" " " 21 " " 25 "
No. 6	" " " 17 " " 20 "
No. 7	" " " 14 " " 16 "
No. 8	" " " 12 " " 13 "

In ordering, state number of cutter and diametral pitch.

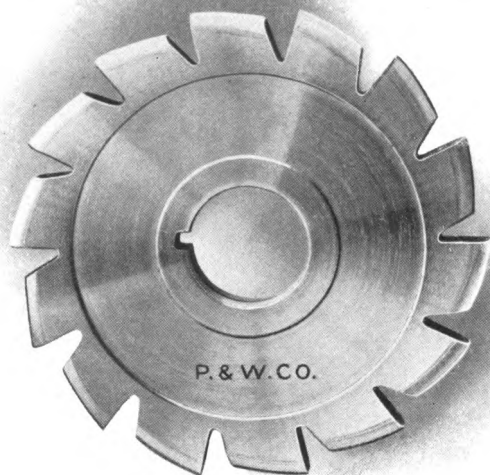
Sizes and Prices of Involute Gear Cutters

Diametral Pitch	Diameter of Cutter Inches	Diameter of Hole Inches	Price Each	Diametral Pitch	Diameter of Cutter Inches	Diameter of Hole Inches	Price Each
*1¼	7¼	1½	\$32 00	14	2	¾	\$2 55
*1½	6½	1½	24 00	*15	2	¾	2 50
*1¾	5¾	1½	18 50	16	1½	¾	2 45
2	5	1¼	12 50	18	1½	¾	2 35
*2¼	4½	1¼	11 25	20	1¾	¾	2 30
2½	4¼	1¼	10 00	22	1½	¾	2 20
*2¾	4	1¼	9 00	24	1¾	¾	2 10
3	3½	1¼	7 00	26	1¾	¾	1 95
*3¼	3½	1¼	6 50	28	1¾	¾	1 80
*3½	3⅞	1¼	6 25	30	1¾	¾	1 80
*3¾	3⅞	1¼	6 00	32	1¾	¾	1 80
4	3¾	1¼	5 50	36	1¾	¾	1 80
*4½	3¼	1¼	5 00	*38	1¾	¾	1 80
5	3⅞	1¼	4 50	40	1¾	¾	1 80
*5½	3⅞	1¼	4 20	*44	1¾	¾	1 80
6	2¾	1⅞	3 90	48	1¾	¾	1 80
7	2⅞	1⅞	3 60	*50	1¾	¾	1 80
8	2½	1⅞	3 40	*56	1¾	¾	1 80
9	2¾	1⅞	3 20	*60	1¾	¾	1 80
10	2⅞	¾	3 00	*64	1¾	¾	1 80
11	2⅞	¾	2 75	*70	1¾	¾	1 80
12	2	¾	2 65	*80	1¾	¾	1 80
*13	2	¾	2 60	*120	1¾	¾	1 80

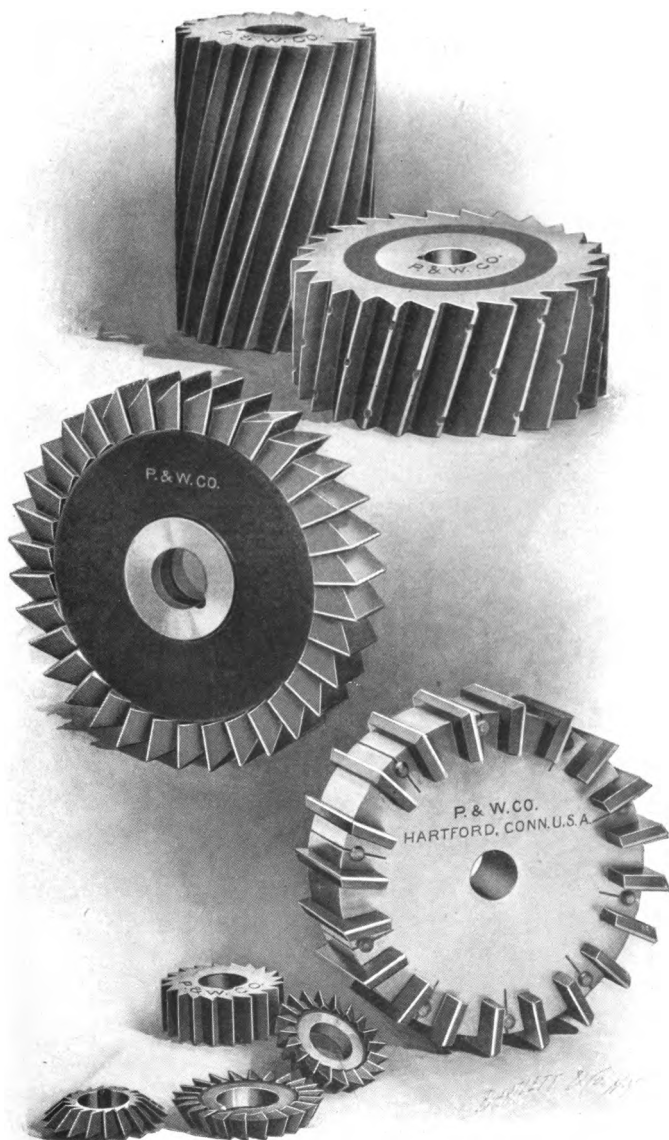
Cutters marked * are made to order.

Stocking Cutters

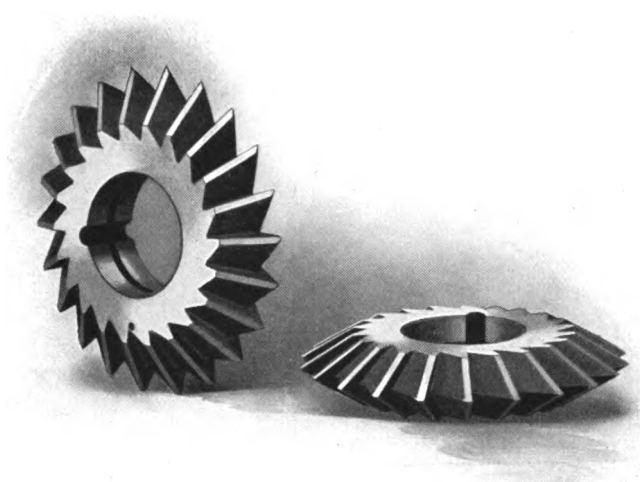
For Involute Gears



Diametral Pitch	Diameter Inches	Hole Inches	Price Each
1¼	7¼	1½	\$19 20
1½	6½	1½	14 40
1¾	5¾	1½	11 10
2	5	1¼	7 50
2¼	4½	1¼	6 75
2½	4¼	1¼	6 00
2¾	4	1¼	5 40
3	3¾	1¼	4 20
3¼	3¾	1¼	3 90
3½	3¾	1¼	3 75
3¾	3½	1¼	3 60
4	3¾	1¼	3 30
4½	3¼	1¼	3 00
5	3¼	1¼	2 70
5½	2¾	1¼	2 50
6	2¾	1 1/8	2 35
7	2¾	1 1/8	2 20
8	2½	1 1/8	2 05



Double Angle Cutters



Square or Half-round Keyway

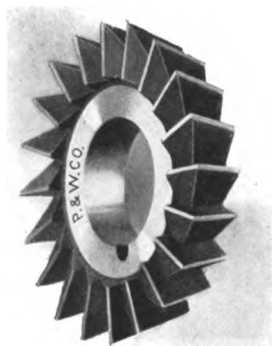
We keep in stock a form of cutter, as shown in the cut, with the included angle either 45, 60 or 90 degrees.

Diameter Inches	Thickness Inches	Size of Hole Inches	Price Each
2½	½	⅞ and 1	\$2 70
2¾	½	1	3 00
3	½	1¼	3 25

Angular Cutters

Square or Half-round Keyway

Right- and left-hand for cutting the teeth of mills and cutters. Are made and carried in stock with inclusive angles of 45, 50, 60, 70 and 80 degrees.



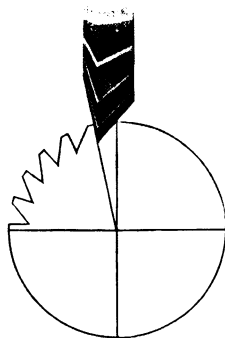
Diameter Inches	Thick- ness Inches	Hole Inches	Price Each
2½	½	⅞ and 1	\$2 70
2¾	½	1	3 00
3	½	1¼	3 25
3¼	½	1½	3 75

Cutters for Spiral Mills

Square or Half-round Keyway

The cut shows a form of cutter adapted to cutting spiral mills. The inclusive angle is 52 degrees, 40 degrees on one side and 12 on the other.

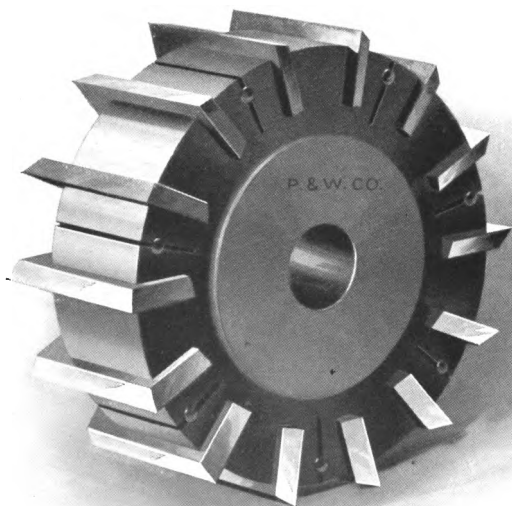
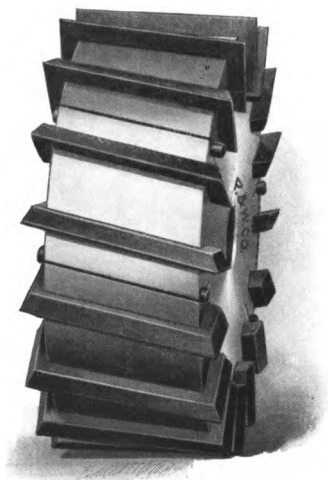
The cut illustrates a cutter at work, in the position required in cutting the teeth of a spiral mill.



Diameter Inches	Thickness Inches	Hole Inches	Price Each
2½	½	⅞ and 1	\$2 70
2¾	½	1	3 00
3	½	1¼	3 25
3¼	½	1½	3 75

Inserted Blade Milling Cutters

Patented February 12, 1895



Inserted Blade Milling Cutters

Patented February 12, 1895

These cutters are made for surface, end or side milling.

The bodies are cast-iron and the inserted blades a high grade of tool steel. In large cutters a much more durable tool can be made in this way than from the solid stock.

When ordering, state whether cutters are for surface, end or side milling.

Price of Milling Cutters—Plain Hole

Diameter Inches	Face Inches	Price Each	Diameter Inches	Face Inches	Price Each
4	2	\$14 00	8	2½	\$22 00
5	2	15 00	10	2½	26 00
6	2½	17 00	12	2½	32 00
7	2½	20 00			

Price of End or Face Cutters—Plain Hole

Diameter Inches	Face Inches	Price Each	Diameter Inches	Face Inches	Price Each
5½	2¼	\$12 00	8½	2¼	\$18 00
6½	2¼	14 00	9½	2¼	20 00
7½	2¼	16 00			

Price of Side Cutters—Plain Hole

Diameter Inches	Face Inches	Price Each	Diameter Inches	Face Inches	Price Each
6	2	\$17 00	9	2	\$24 00
7	2	20 00	10	2	26 00
8	2	22 00			

In ordering, give size of spindle on which cutter is to be used.

For price of cutter with threaded hole, increase the list price by \$4.50.

In ordering threaded hole cutters, state diameter of threaded spindle on which cutter is to be used, number of threads per inch, form of thread, and whether left or right.

Above cutters will be furnished with high-speed steel blades; prices on application.

Screw-slotting Cutters



These cutters have fine teeth, which are best adapted for screw-slotting and similar work.

In ordering, always state thickness in decimal parts of an inch and not by wire gauge.

These cutters are not ground on the sides.

Thickness of Cutter by American Standard Wire Gauge	Thickness of Cutter in Decimals	Diameter of Cutter Inches	Size of Hole Inches	Price Each
No. 5	.182	2 3/4	1	\$0 70
6	.162	2 1/4	1	60
7	.144	2 1/4	1	50
8	.128	2 1/4	3/4, 1	45
9	.114	2 1/4	3/4, 1	40
10	.102	2 1/4	3/4, 1	35
11	.091	2 1/4	3/4, 1	30
12	.081	2 1/4	3/4, 1	25
13	.072	2 1/4	3/4, 1	20
14	.064	2 1/4	3/4, 1	20
15	.057	2 1/4	1/2, 5/8, 3/4, 1	15
16	.051	2 1/4	1/2, 5/8, 3/4, 1	15
17	.045	2 1/4	1/2, 5/8, 3/4, 1	15
18	.040	2 1/4	1/2, 5/8, 3/4, 1	15
19	.035	2 1/4	1/2, 5/8, 3/4, 1	15
20	.032	2 1/4	1/2, 5/8, 3/4, 1	15
21	.028	2 1/4	1/2, 5/8, 3/4, 1	15
22	.025	2 1/4	1/2, 5/8, 3/4, 1	15
23	.023	2 1/4	1/2, 5/8, 3/4, 1	15
24	.020	2 1/4	1/2, 5/8, 3/4, 1	15
25	.018	2 1/4	1/2, 5/8, 3/4, 1	15
26	.016	2 1/4	1/2, 5/8, 3/4, 1	15

Screw-slotting Cutters—*Continued*

Thickness of Cutter by American Standard Wire Gauge	Thickness of Cutter in Decimals	Diameter of Cutter Inches	Size of Hole Inches	Price Each
No. 27	.014	2 $\frac{3}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, 1	\$0 15
28	.012	2 $\frac{3}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, 1	15
30	.010	2 $\frac{3}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, 1	15
32	.008	2 $\frac{3}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, 1	15
34	.006	2 $\frac{3}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, 1	15
10	.102	2 $\frac{1}{4}$	$\frac{5}{8}$	30
11	.091	2 $\frac{1}{4}$	$\frac{5}{8}$	25
12	.081	2 $\frac{1}{4}$	$\frac{5}{8}$	20
13	.072	2 $\frac{1}{4}$	$\frac{5}{8}$	15
14	.064	2 $\frac{1}{4}$	$\frac{5}{8}$	15
15	.057	2 $\frac{1}{4}$	$\frac{5}{8}$	15
16	.051	2 $\frac{1}{4}$	$\frac{5}{8}$	15
17	.045	2 $\frac{1}{4}$	$\frac{5}{8}$	15
18	.040	2 $\frac{1}{4}$	$\frac{5}{8}$	15
19	.035	2 $\frac{1}{4}$	$\frac{5}{8}$	15
20	.032	2 $\frac{1}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$	15
21	.028	2 $\frac{1}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$	15
22	.025	2 $\frac{1}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$	15
23	.023	2 $\frac{1}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$	15
24	.020	2 $\frac{1}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$	15
25	.018	2 $\frac{1}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$	15
26	.016	2 $\frac{1}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$	15
27	.014	2 $\frac{1}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$	15
28	.012	2 $\frac{1}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$	15
30	.010	2 $\frac{1}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$	15
32	.008	2 $\frac{1}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$	15
34	.006	2 $\frac{1}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$	15
14	.064	1 $\frac{3}{4}$	$\frac{5}{8}$	15
15	.057	1 $\frac{3}{4}$	$\frac{5}{8}$	15
16	.051	1 $\frac{3}{4}$	$\frac{5}{8}$	15
17	.045	1 $\frac{3}{4}$	$\frac{5}{8}$	15
18	.040	1 $\frac{3}{4}$	$\frac{5}{8}$	15
19	.035	1 $\frac{3}{4}$	$\frac{5}{8}$	15
20	.032	1 $\frac{3}{4}$	$\frac{5}{8}$	15
21	.028	1 $\frac{3}{4}$	$\frac{5}{8}$	15
22	.025	1 $\frac{3}{4}$	$\frac{5}{8}$	15
23	.023	1 $\frac{3}{4}$	$\frac{5}{8}$	15
24	.020	1 $\frac{3}{4}$	$\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$	12
25	.018	1 $\frac{3}{4}$	$\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$	12
26	.016	1 $\frac{3}{4}$	$\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$	12
27	.014	1 $\frac{3}{4}$	$\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$	12
28	.012	1 $\frac{3}{4}$	$\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$	12
30	.010	1 $\frac{3}{4}$	$\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$	12
32	.008	1 $\frac{3}{4}$	$\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$	12
34	.006	1 $\frac{3}{4}$	$\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$	12

Cutters varying from the list are made to order.

Screw-slotting Cutters



These cutters have fine teeth, which are best adapted for screw-slotting and similar work.

In ordering, always state thickness in decimal parts of an inch and not by wire gauge.

These cutters are not ground on the sides.

No.	Thickness of Cutter by American Standard Wire Gauge	Thickness of Cutter in Decimals	Diameter of Cutter Inches	Size of Hole Inches	Price Each
5		.182	2 $\frac{3}{4}$	1	\$0 70
6		.162	2 $\frac{3}{4}$	1	60
7		.144	2 $\frac{3}{4}$	1	50
8		.128	2 $\frac{3}{4}$	$\frac{3}{4}$, 1	45
9		.114	2 $\frac{3}{4}$	$\frac{3}{4}$, 1	40
10		.102	2 $\frac{3}{4}$	$\frac{3}{4}$, 1	35
11		.091	2 $\frac{3}{4}$	$\frac{3}{4}$, 1	30
12		.081	2 $\frac{3}{4}$	$\frac{3}{4}$, 1	25
13		.072	2 $\frac{3}{4}$	$\frac{3}{4}$, 1	20
14		.064	2 $\frac{3}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, 1	20
15		.057	2 $\frac{3}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, 1	15
16		.051	2 $\frac{3}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, 1	15
17		.045	2 $\frac{3}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, 1	15
18		.040	2 $\frac{3}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, 1	15
19		.035	2 $\frac{3}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, 1	15
20		.032	2 $\frac{3}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, 1	15
21		.028	2 $\frac{3}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, 1	15
22		.025	2 $\frac{3}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, 1	15
23		.023	2 $\frac{3}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, 1	15
24		.020	2 $\frac{3}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, 1	15
25		.018	2 $\frac{3}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, 1	15
26		.016	2 $\frac{3}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, 1	15

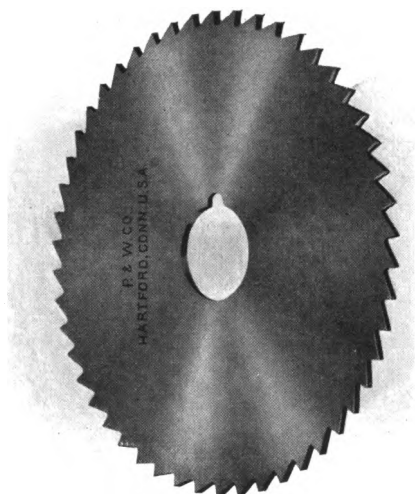
Screw-slotting Cutters—*Continued*

Thickness of Cutter by American Standard Wire Gauge	Thickness of Cutter in Decimals	Diameter of Cutter Inches	Size of Hole Inches	Price Each
No. 27	.014	2 $\frac{3}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, 1	\$0 15
28	.012	2 $\frac{3}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, 1	15
30	.010	2 $\frac{3}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, 1	15
32	.008	2 $\frac{3}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, 1	15
34	.006	2 $\frac{3}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, 1	15
10	.102	2 $\frac{1}{4}$	$\frac{5}{8}$	30
11	.091	2 $\frac{1}{4}$	$\frac{5}{8}$	25
12	.081	2 $\frac{1}{4}$	$\frac{5}{8}$	20
13	.072	2 $\frac{1}{4}$	$\frac{5}{8}$	15
14	.064	2 $\frac{1}{4}$	$\frac{5}{8}$	15
15	.057	2 $\frac{1}{4}$	$\frac{5}{8}$	15
16	.051	2 $\frac{1}{4}$	$\frac{5}{8}$	15
17	.045	2 $\frac{1}{4}$	$\frac{5}{8}$	15
18	.040	2 $\frac{1}{4}$	$\frac{5}{8}$	15
19	.035	2 $\frac{1}{4}$	$\frac{5}{8}$	15
20	.032	2 $\frac{1}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$	15
21	.028	2 $\frac{1}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$	15
22	.025	2 $\frac{1}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$	15
23	.023	2 $\frac{1}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$	15
24	.020	2 $\frac{1}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$	15
25	.018	2 $\frac{1}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$	15
26	.016	2 $\frac{1}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$	15
27	.014	2 $\frac{1}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$	15
28	.012	2 $\frac{1}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$	15
30	.010	2 $\frac{1}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$	15
32	.008	2 $\frac{1}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$	15
34	.006	2 $\frac{1}{4}$	$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$	15
14	.064	1 $\frac{3}{4}$	$\frac{5}{8}$	15
15	.057	1 $\frac{3}{4}$	$\frac{5}{8}$	15
16	.051	1 $\frac{3}{4}$	$\frac{5}{8}$	15
17	.045	1 $\frac{3}{4}$	$\frac{5}{8}$	15
18	.040	1 $\frac{3}{4}$	$\frac{5}{8}$	15
19	.035	1 $\frac{3}{4}$	$\frac{5}{8}$	15
20	.032	1 $\frac{3}{4}$	$\frac{5}{8}$	15
21	.028	1 $\frac{3}{4}$	$\frac{5}{8}$	15
22	.025	1 $\frac{3}{4}$	$\frac{5}{8}$	15
23	.023	1 $\frac{3}{4}$	$\frac{5}{8}$	15
24	.020	1 $\frac{3}{4}$	$\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$	12
25	.018	1 $\frac{3}{4}$	$\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$	12
26	.016	1 $\frac{3}{4}$	$\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$	12
27	.014	1 $\frac{3}{4}$	$\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$	12
28	.012	1 $\frac{3}{4}$	$\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$	12
30	.010	1 $\frac{3}{4}$	$\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$	12
32	.008	1 $\frac{3}{4}$	$\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$	12
34	.006	1 $\frac{3}{4}$	$\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$	12

Cutters varying from the list are made to order.

Metal Slitting Cutters

Process Patented September 5, 1893



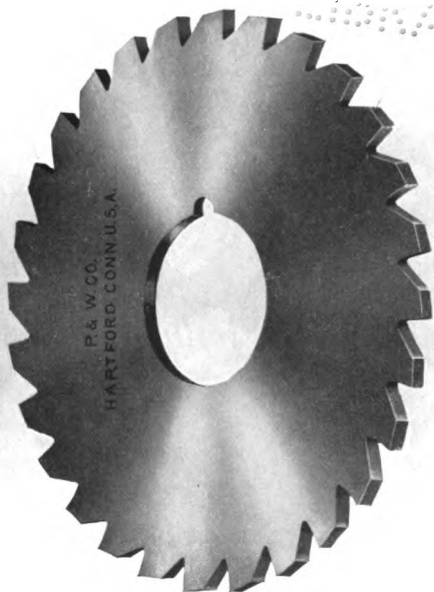
Square or Half-round Keyway

The temper is suitable for cutting metals. The sides are finished true by grinding, and a little thicker at the outside edge than near the center, for proper clearance. Coarse teeth are best adapted for brass work and deep slots, fine teeth for cutting thin metal. In ordering, please mention the kind of work for which they are intended.

Diameter Inches	Thickness Inches	Size Hole Inches	Price Each	Diameter Inches	Thickness Inches	Size Hole Inches	Price Each
2 1/2	1/32	7/8 and 1	\$1 00	4	3/16	1	\$1 60
2 1/2	3/64	7/8 and 1	1 00	5	1/16	1	1 80
2 1/2	1/16	7/8 and 1	90	5	3/32	1	1 60
2 1/2	3/32	7/8 and 1	90	5	1/8	1	1 50
2 1/2	1/8	7/8 and 1	90	5	1/8	1 1/4	1 50
2 1/2	5/32	7/8 and 1	1 10	5	1/8	1 1/2	1 50
3	1/32	1	1 25	5	5/32	1	1 90
3	3/64	1	1 10	5	3/16	1	2 30
3	1/16	1	1 00	6	1/16	1	4 00
3	3/32	1	1 00	6	3/32	1	3 00
3	1/8	1	1 00	6	1/8	1	2 70
3	5/32	1	1 15	6	3/16	1 3/4	3 50
4	1/32	1	2 25	6	1/16	1 1/2	3 50
4	3/64	1	1 45	6	3/16	1	3 50
4	1/16	1	1 25	7	1/16	1	7 50
4	3/32	1	1 20	7	3/32	1	4 50
4	1/8	1	1 20	7	1/8	1	3 80
4	5/32	1	1 40	8	1/8	1	5 75

Cutters for Key-seating and Slotting

With Relieved Teeth



Square or Half-round Keyway

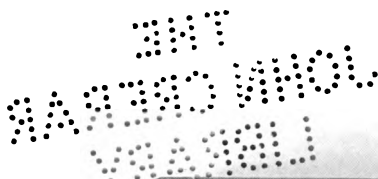
These cutters are recommended where heavy work is to be done.

The teeth are made extra strong, and the sides are ground concave for clearance.

Prices on application.

End Mills

Morse Taper



Left-hand Mill

In ordering, state whether right- or left-hand mills are wanted.

Diam. Inches	No. of Taper Shank	Length of Cut Inches	Whole Length Inches	Price Each	Diam. Inches	No. of Taper Shank	Length of Cut Inches	Whole Length Inches	Price Each
$\frac{1}{4}$	1	$\frac{1}{8}$	$3\frac{3}{8}$	\$1 15	1	3	$1\frac{7}{8}$	$6\frac{1}{16}$	\$2 30
$\frac{5}{16}$	1	$\frac{7}{8}$	$3\frac{11}{16}$	1 15	$1\frac{1}{16}$	2	$1\frac{7}{8}$	$5\frac{5}{16}$	2 15
$\frac{3}{8}$	1	$\frac{7}{8}$	$3\frac{11}{16}$	1 20	$1\frac{1}{16}$	3	$1\frac{7}{8}$	$6\frac{1}{16}$	2 30
$\frac{7}{16}$	1	$1\frac{5}{8}$	$3\frac{3}{4}$	1 25	$1\frac{1}{8}$	3	2	$6\frac{3}{16}$	2 35
$\frac{1}{2}$	2	1	$4\frac{7}{8}$	1 40	$1\frac{3}{8}$	3	2	$6\frac{3}{16}$	2 40
$\frac{5}{8}$	1	1	$3\frac{1}{2}$	1 30	$1\frac{1}{2}$	3	2	$6\frac{3}{16}$	2 45
$\frac{1}{2}$	2	$1\frac{1}{8}$	$4\frac{9}{8}$	1 45	$1\frac{1}{4}$	4	2	$7\frac{1}{4}$	2 55
$\frac{3}{4}$	1	$1\frac{1}{8}$	$3\frac{7}{8}$	1 35	$1\frac{5}{8}$	3	$2\frac{1}{8}$	$6\frac{5}{16}$	2 65
$\frac{7}{8}$	2	$1\frac{1}{4}$	$4\frac{1}{8}$	1 50	$1\frac{5}{4}$	4	$2\frac{1}{8}$	$7\frac{3}{8}$	2 75
$\frac{1}{8}$	2	$1\frac{1}{2}$	4	1 55	$1\frac{3}{8}$	3	$2\frac{1}{8}$	$6\frac{5}{16}$	2 65
$\frac{1}{4}$	2	$1\frac{5}{8}$	$4\frac{1}{8}$	1 75	$1\frac{1}{2}$	4	$2\frac{1}{8}$	$7\frac{3}{8}$	2 75
$\frac{3}{8}$	2	$1\frac{3}{4}$	$5\frac{1}{8}$	1 80	$1\frac{7}{8}$	3	$2\frac{1}{4}$	$6\frac{7}{16}$	2 75
$\frac{1}{2}$	3	$1\frac{3}{4}$	$5\frac{1}{8}$	1 95	$1\frac{7}{8}$	4	$2\frac{1}{4}$	$7\frac{1}{2}$	3 00
$\frac{5}{8}$	2	$1\frac{3}{4}$	$5\frac{1}{8}$	1 90	$1\frac{1}{2}$	3	$2\frac{1}{4}$	$6\frac{7}{16}$	2 75
$\frac{3}{4}$	3	$1\frac{3}{4}$	$5\frac{1}{8}$	2 00	$1\frac{1}{2}$	4	$2\frac{1}{4}$	$7\frac{1}{2}$	3 00
$\frac{7}{8}$	2	$1\frac{3}{4}$	$5\frac{3}{8}$	2 10	$1\frac{3}{4}$	4	$2\frac{3}{8}$	$7\frac{3}{8}$	3 25
$\frac{1}{8}$	3	$1\frac{3}{4}$	$5\frac{3}{8}$	2 25	$1\frac{3}{4}$	4	$2\frac{3}{8}$	$7\frac{3}{8}$	3 50
$\frac{1}{4}$	2	$1\frac{3}{4}$	$5\frac{3}{8}$	2 10	$1\frac{7}{8}$	4	$2\frac{1}{2}$	$7\frac{3}{4}$	3 75
$\frac{3}{8}$	3	$1\frac{3}{4}$	$5\frac{3}{8}$	2 25	2	4	$2\frac{1}{2}$	$7\frac{3}{4}$	4 00
1	2	$1\frac{7}{8}$	$5\frac{3}{8}$	2 15					

Spiral End Mills

Morse Taper



Left-hand Mill

In ordering, state whether right- or left-hand mills are wanted.

Diam. Inches	No. of Taper Shank	Length of Cut Inches	Whole Length Inches	Price Each	Diam. Inches	No. of Taper Shank	Length of Cut Inches	Whole Length Inches	Price Each
$\frac{1}{2}$	1	1	$3\frac{3}{16}$	\$1 30	$1\frac{1}{16}$	3	$1\frac{7}{8}$	$6\frac{1}{16}$	\$2 30
$\frac{1}{2}$	2	$1\frac{1}{8}$	$4\frac{9}{16}$	1 45	$1\frac{1}{8}$	3	2	$6\frac{3}{16}$	2 35
$\frac{9}{16}$	1	$1\frac{1}{16}$	$3\frac{7}{8}$	1 35	$1\frac{3}{16}$	3	2	$6\frac{3}{16}$	2 40
$\frac{9}{16}$	2	$1\frac{1}{4}$	$4\frac{11}{16}$	1 50	$1\frac{1}{4}$	3	2	$6\frac{3}{16}$	2 45
$\frac{5}{8}$	2	$1\frac{1}{2}$	$4\frac{1}{8}$	1 55	$1\frac{1}{4}$	4	2	$7\frac{1}{4}$	2 55
$\frac{11}{16}$	2	$1\frac{1}{2}$	$4\frac{15}{16}$	1 75	$1\frac{5}{8}$	3	$2\frac{1}{8}$	$6\frac{5}{16}$	2 65
$\frac{11}{16}$	2	$1\frac{3}{8}$	$5\frac{1}{16}$	1 80	$1\frac{5}{8}$	4	$2\frac{1}{8}$	$7\frac{3}{8}$	2 75
$\frac{3}{4}$	3	$1\frac{5}{8}$	$5\frac{3}{16}$	1 95	$1\frac{3}{4}$	3	$2\frac{1}{8}$	$6\frac{5}{16}$	2 65
$1\frac{1}{16}$	2	$1\frac{5}{8}$	$5\frac{1}{16}$	1 90	$1\frac{3}{4}$	4	$2\frac{1}{8}$	$7\frac{3}{8}$	2 75
$1\frac{1}{8}$	3	$1\frac{5}{8}$	$5\frac{1}{16}$	2 00	$1\frac{7}{8}$	3	$2\frac{1}{4}$	$6\frac{7}{16}$	2 75
$1\frac{1}{8}$	2	$1\frac{3}{4}$	$5\frac{3}{16}$	2 10	$1\frac{7}{8}$	4	$2\frac{1}{4}$	$7\frac{1}{2}$	3 00
$\frac{7}{8}$	3	$1\frac{3}{4}$	$5\frac{13}{16}$	2 25	$1\frac{1}{2}$	3	$2\frac{1}{4}$	$6\frac{7}{16}$	2 75
$1\frac{5}{16}$	2	$1\frac{3}{4}$	$5\frac{3}{16}$	2 10	$1\frac{1}{2}$	4	$2\frac{1}{4}$	$7\frac{1}{2}$	3 00
$1\frac{5}{16}$	3	$1\frac{3}{4}$	$5\frac{13}{16}$	2 25	$1\frac{1}{2}$	4	$2\frac{3}{8}$	$7\frac{5}{8}$	3 25
$1\frac{1}{8}$	2	$1\frac{7}{8}$	$5\frac{5}{16}$	2 15	$1\frac{3}{4}$	4	$2\frac{3}{8}$	$7\frac{5}{8}$	3 50
1	3	$1\frac{7}{8}$	$6\frac{1}{16}$	2 30	$1\frac{7}{8}$	4	$2\frac{1}{2}$	$7\frac{3}{4}$	3 75
$1\frac{1}{8}$	2	$1\frac{7}{8}$	$5\frac{5}{16}$	2 15	2	4	$2\frac{1}{2}$	$7\frac{3}{4}$	4 00

End Mills

Brown & Sharpe Taper



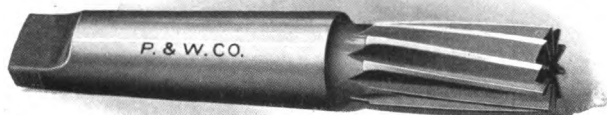
Left-hand Mill

In ordering, state whether right- or left-hand mills are wanted.

Diam. Inches	No. of Taper Shank	Length of Cut Inches	Whole Length Inches	Price Each	Diam. Inches	No. of Taper Shank	Length of Cut Inches	Whole Length Inches	Price Each
$\frac{1}{4}$	4	$\frac{1}{8}$	$2\frac{7}{8}$	\$1 00	$\frac{7}{8}$	7	$1\frac{1}{4}$	$5\frac{3}{4}$	\$2 10
$\frac{1}{4}$	5	$\frac{1}{8}$	3	1 15	$\frac{7}{8}$	9	$1\frac{1}{4}$	7	2 25
$\frac{5}{16}$	4	$\frac{7}{8}$	$2\frac{1}{2}$	1 00	$\frac{15}{16}$	7	$1\frac{1}{4}$	$5\frac{3}{4}$	2 10
$\frac{5}{16}$	5	$\frac{7}{8}$	$3\frac{1}{8}$	1 15	$\frac{15}{16}$	9	$1\frac{1}{4}$	7	2 25
$\frac{3}{8}$	4	$\frac{7}{8}$	$2\frac{1}{2}$	1 10	1	7	$1\frac{7}{8}$	$5\frac{7}{8}$	2 15
$\frac{3}{8}$	5	$\frac{7}{8}$	$3\frac{1}{8}$	1 20	1	9	$1\frac{7}{8}$	$7\frac{1}{8}$	2 30
$\frac{7}{16}$	4	$\frac{15}{16}$	$2\frac{9}{16}$	1 10	$1\frac{1}{16}$	7	$1\frac{7}{8}$	$5\frac{7}{8}$	2 15
$\frac{7}{16}$	5	$\frac{15}{16}$	$3\frac{1}{8}$	1 25	$1\frac{1}{16}$	9	$1\frac{7}{8}$	$7\frac{1}{8}$	2 35
$\frac{1}{2}$	5	1	$3\frac{3}{8}$	1 30	$1\frac{1}{8}$	7	2	6	2 25
$\frac{9}{16}$	7	$1\frac{1}{8}$	$5\frac{1}{8}$	1 45	$1\frac{1}{8}$	9	2	$7\frac{1}{4}$	2 40
$\frac{9}{16}$	5	$1\frac{1}{8}$	$3\frac{1}{4}$	1 35	$1\frac{3}{8}$	7	2	6	2 25
$\frac{5}{8}$	7	$1\frac{1}{4}$	$5\frac{1}{4}$	1 50	$1\frac{3}{8}$	9	2	$7\frac{1}{4}$	2 50
$\frac{5}{8}$	5	$1\frac{1}{4}$	$3\frac{7}{8}$	1 45	$1\frac{1}{2}$	7	2	6	2 25
$\frac{3}{4}$	7	$1\frac{1}{2}$	$5\frac{1}{2}$	1 70	$1\frac{1}{2}$	9	2	$7\frac{1}{4}$	2 55
$\frac{11}{16}$	7	$1\frac{1}{2}$	$5\frac{1}{2}$	1 75	$1\frac{5}{8}$	9	$2\frac{1}{8}$	$7\frac{3}{8}$	2 75
$\frac{11}{16}$	9	$1\frac{1}{2}$	$6\frac{3}{4}$	1 90	$1\frac{3}{4}$	9	$2\frac{1}{8}$	$7\frac{3}{8}$	2 75
$\frac{3}{4}$	7	$1\frac{5}{8}$	$5\frac{5}{8}$	1 80	$1\frac{7}{8}$	9	$2\frac{1}{4}$	$7\frac{1}{2}$	3 00
$\frac{3}{4}$	9	$1\frac{5}{8}$	$6\frac{7}{8}$	1 95	$1\frac{1}{2}$	9	$2\frac{1}{4}$	$7\frac{1}{2}$	3 00
$\frac{13}{16}$	7	$1\frac{5}{8}$	$5\frac{5}{8}$	1 90	$1\frac{5}{8}$	9	$2\frac{3}{8}$	$7\frac{5}{8}$	3 25
$\frac{13}{16}$	9	$1\frac{5}{8}$	$6\frac{7}{8}$	2 00	$1\frac{3}{4}$	9	$2\frac{1}{2}$	$7\frac{3}{4}$	3 50

Spiral End Mills

Brown & Sharpe Taper



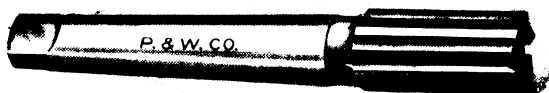
Left-hand Mill

In ordering, state whether right- or left-hand mills are wanted.

Diam. Inches	No. of Taper Shank	Length of Cut Inches	Whole Length Inches	Price Each	Diam. Inches	No. of Taper Shank	Length of Cut Inches	Whole Length Inches	Price Each
$\frac{1}{4}$	4	$\frac{1\frac{3}{8}}$	$2\frac{7}{8}$	\$1 00	$\frac{7}{8}$	7	$1\frac{3}{4}$	$5\frac{3}{4}$	\$2 10
$\frac{1}{4}$	5	$\frac{1\frac{3}{8}}$	3	1 15	$\frac{7}{8}$	9	$1\frac{3}{4}$	7	2 25
$\frac{5}{16}$	4	$\frac{7}{8}$	$2\frac{1}{2}$	1 00	$\frac{1\frac{5}{8}}$	7	$1\frac{3}{4}$	$5\frac{3}{4}$	2 10
$\frac{5}{16}$	5	$\frac{7}{8}$	$3\frac{1}{8}$	1 15	$\frac{1\frac{5}{8}}$	9	$1\frac{3}{4}$	7	2 25
$\frac{3}{8}$	4	$\frac{7}{8}$	$2\frac{1}{2}$	1 10	1	7	$1\frac{7}{8}$	$5\frac{7}{8}$	2 15
$\frac{3}{8}$	5	$\frac{7}{8}$	$3\frac{1}{8}$	1 20	1	9	$1\frac{7}{8}$	$7\frac{1}{8}$	2 30
$\frac{7}{8}$	4	$\frac{1\frac{3}{8}}$	$2\frac{9}{16}$	1 10	$1\frac{1}{8}$	7	$1\frac{7}{8}$	$5\frac{7}{8}$	2 15
$\frac{7}{8}$	5	$\frac{1\frac{3}{8}}$	$3\frac{3}{8}$	1 25	$1\frac{1}{8}$	9	$1\frac{7}{8}$	$7\frac{1}{8}$	2 35
$\frac{1}{2}$	5	1	$3\frac{3}{8}$	1 30	$1\frac{1}{8}$	7	2	6	2 25
$\frac{1}{2}$	7	$1\frac{1}{8}$	$5\frac{1}{8}$	1 45	$1\frac{1}{8}$	9	2	$7\frac{1}{4}$	2 40
$\frac{9}{16}$	5	$1\frac{1}{8}$	$3\frac{1}{4}$	1 35	$1\frac{3}{8}$	7	2	6	2 25
$\frac{9}{16}$	7	$1\frac{1}{4}$	$5\frac{1}{4}$	1 50	$1\frac{3}{8}$	9	2	$7\frac{1}{4}$	2 50
$\frac{5}{8}$	5	$1\frac{1}{4}$	$3\frac{7}{8}$	1 45	$1\frac{1}{4}$	7	2	6	2 25
$\frac{5}{8}$	7	$1\frac{1}{2}$	$5\frac{1}{2}$	1 70	$1\frac{1}{4}$	9	2	$7\frac{1}{4}$	2 55
$\frac{11}{16}$	7	$1\frac{1}{2}$	$5\frac{1}{2}$	1 75	$1\frac{5}{8}$	9	$2\frac{1}{8}$	$7\frac{3}{8}$	2 75
$\frac{11}{16}$	9	$1\frac{1}{2}$	$6\frac{3}{4}$	1 90	$1\frac{3}{8}$	9	$2\frac{1}{8}$	$7\frac{3}{8}$	2 75
$\frac{3}{4}$	7	$1\frac{5}{8}$	$5\frac{5}{8}$	1 80	$1\frac{7}{8}$	9	$2\frac{1}{4}$	$7\frac{1}{2}$	3 00
$\frac{3}{4}$	9	$1\frac{5}{8}$	$6\frac{7}{8}$	1 95	$1\frac{1}{2}$	9	$2\frac{1}{4}$	$7\frac{1}{2}$	3 00
$\frac{13}{16}$	7	$1\frac{5}{8}$	$5\frac{5}{8}$	1 90	$1\frac{5}{8}$	9	$2\frac{3}{8}$	$7\frac{5}{8}$	3 25
$\frac{13}{16}$	9	$1\frac{5}{8}$	$6\frac{7}{8}$	2 00	$1\frac{3}{4}$	9	$2\frac{1}{2}$	$7\frac{3}{4}$	3 50

End Mills with Center Cut

Morse Taper



Left-hand Mill

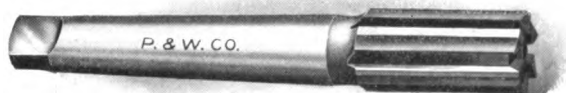
In ordering, state whether right- or left-hand mills are wanted.

These end mills are useful where it is desired to cut into the work with the end of the mill and then move along as in cams, grooves, etc., as the teeth are sharp on the inside, and thus cut a path out from the first entering point. They are also useful in taking heavy cuts, especially in cast iron.

Diam. Inches	No. of Taper Shank	Length of Cut Inches	Whole Length Inches	Price Each	Diam. Inches	No. of Taper Shank	Length of Cut Inches	Whole Length Inches	Price Each
$\frac{1}{2}$	1	1	$3\frac{13}{16}$	\$1 50	1	3	$1\frac{7}{8}$	$6\frac{1}{16}$	\$2 85
$\frac{1}{2}$	2	$1\frac{1}{8}$	$4\frac{9}{16}$	1 80	$1\frac{1}{16}$	2	$1\frac{7}{8}$	$5\frac{5}{16}$	2 70
$\frac{9}{16}$	1	$1\frac{1}{16}$	$3\frac{7}{8}$	1 70	$1\frac{1}{16}$	3	$1\frac{7}{8}$	$6\frac{1}{16}$	2 95
$\frac{9}{16}$	2	$1\frac{1}{4}$	$4\frac{11}{16}$	1 85	$1\frac{1}{8}$	3	2	$6\frac{3}{16}$	3 00
$\frac{5}{8}$	2	$1\frac{1}{2}$	$4\frac{15}{16}$	2 10	$1\frac{3}{16}$	3	2	$6\frac{3}{16}$	3 10
$\frac{11}{16}$	2	$1\frac{1}{2}$	$4\frac{15}{16}$	2 15	$1\frac{1}{4}$	3	2	$6\frac{3}{16}$	3 20
$\frac{3}{4}$	2	$1\frac{5}{8}$	$5\frac{1}{16}$	2 25	$1\frac{1}{4}$	4	2	$7\frac{1}{4}$	3 30
$\frac{3}{4}$	3	$1\frac{5}{8}$	$5\frac{1}{16}$	2 45	$1\frac{5}{16}$	3	$2\frac{1}{8}$	$6\frac{5}{16}$	3 45
$\frac{13}{16}$	2	$1\frac{5}{8}$	$5\frac{1}{16}$	2 35	$1\frac{5}{16}$	4	$2\frac{1}{8}$	$7\frac{3}{8}$	3 55
$\frac{13}{16}$	3	$1\frac{5}{8}$	$5\frac{1}{16}$	2 50	$1\frac{3}{8}$	3	$2\frac{1}{8}$	$6\frac{5}{16}$	3 45
$\frac{7}{8}$	2	$1\frac{3}{4}$	$5\frac{3}{16}$	2 60	$1\frac{3}{8}$	4	$2\frac{1}{8}$	$7\frac{3}{8}$	3 55
$\frac{7}{8}$	3	$1\frac{3}{4}$	$5\frac{3}{16}$	2 80	$1\frac{7}{16}$	3	$2\frac{1}{4}$	$6\frac{7}{16}$	3 75
$\frac{15}{16}$	2	$1\frac{3}{4}$	$5\frac{3}{16}$	2 60	$1\frac{7}{16}$	4	$2\frac{1}{4}$	$7\frac{1}{2}$	4 00
$\frac{15}{16}$	3	$1\frac{3}{4}$	$5\frac{3}{16}$	2 80	$1\frac{1}{2}$	3	$2\frac{1}{4}$	$6\frac{7}{16}$	3 75
1	2	$1\frac{7}{8}$	$5\frac{5}{16}$	2 70	$1\frac{1}{2}$	4	$2\frac{1}{4}$	$7\frac{1}{2}$	4 00

End Mills with Center Cut

Brown & Sharpe Taper



Left-hand Mill

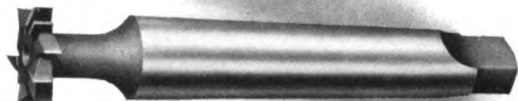
In ordering, state whether right- or left-hand mills are wanted.

These end mills are useful where it is desired to cut into the work with the end of the mill and then move along as in cams, grooves, etc., as the teeth are sharp on the inside, and thus cut a path out from the first entering point. They are also useful in taking heavy cuts, especially in cast iron.

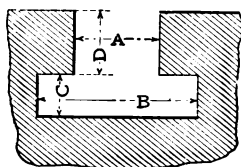
Diam. Inches	No. of Taper Shank	Length of Cut Inches	Whole Length Inches	Price Each	Diam. Inches	No. of Taper Shank	Length of Cut Inches	Whole Length Inches	Price Each
$\frac{1}{2}$	5	1	$3\frac{3}{8}$	\$1 50	$\frac{1}{2}$	9	$1\frac{3}{4}$	7	2 80
$\frac{1}{2}$	7	$1\frac{1}{8}$	$5\frac{1}{8}$	1 80	$\frac{1}{2}$	7	$1\frac{7}{8}$	$5\frac{7}{8}$	2 70
$\frac{9}{16}$	5	1	$3\frac{1}{4}$	1 70	$\frac{9}{16}$	9	$1\frac{1}{8}$	$7\frac{1}{8}$	2 85
$\frac{9}{16}$	7	$1\frac{1}{4}$	$5\frac{1}{4}$	1 85	$\frac{9}{16}$	7	$1\frac{1}{8}$	$5\frac{7}{8}$	2 70
$\frac{5}{8}$	5	$1\frac{1}{4}$	$3\frac{7}{8}$	1 80	$\frac{5}{8}$	9	$1\frac{1}{8}$	$7\frac{1}{8}$	2 95
$\frac{5}{8}$	7	$1\frac{1}{2}$	$5\frac{1}{2}$	2 10	$\frac{5}{8}$	7	2	6	2 80
$\frac{11}{16}$	7	$1\frac{1}{2}$	$5\frac{1}{2}$	2 15	$\frac{11}{16}$	9	2	$7\frac{1}{4}$	3 00
$\frac{11}{16}$	9	$1\frac{1}{2}$	$6\frac{3}{4}$	2 35	$\frac{11}{16}$	7	2	6	2 80
$\frac{3}{4}$	7	$1\frac{1}{2}$	$5\frac{5}{8}$	2 25	$\frac{3}{4}$	9	2	$7\frac{1}{4}$	3 10
$\frac{3}{4}$	9	$1\frac{1}{2}$	$6\frac{7}{8}$	2 45	$\frac{3}{4}$	7	2	6	2 80
$\frac{13}{16}$	7	$1\frac{1}{2}$	$5\frac{5}{8}$	2 35	$\frac{13}{16}$	9	2	$7\frac{1}{4}$	3 20
$\frac{13}{16}$	9	$1\frac{1}{2}$	$6\frac{7}{8}$	2 50	$\frac{13}{16}$	7	$2\frac{1}{8}$	$7\frac{3}{8}$	3 45
$\frac{7}{8}$	7	$1\frac{3}{4}$	$5\frac{3}{4}$	2 60	$\frac{7}{8}$	9	$2\frac{1}{8}$	$7\frac{3}{8}$	3 45
$\frac{7}{8}$	9	$1\frac{3}{4}$	7	2 80	$\frac{7}{8}$	7	$2\frac{1}{4}$	$7\frac{1}{2}$	3 75
$\frac{15}{16}$	7	$1\frac{3}{4}$	$5\frac{3}{4}$	2 60	$\frac{15}{16}$	9	$2\frac{1}{4}$	$7\frac{1}{2}$	3 75

Standard T Slot Cutters

Morse Taper



Left-hand Cutter



In ordering, state whether right- or left-hand cutters are wanted.

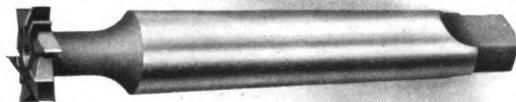
Width of Slot A Inches	Diameter of Neck of Cutter Inches	Width of Slot B Inches	Depth C Inches	Extreme Limit D Inches	No. of Taper Shank	Price Each
$\frac{1}{4}$	$\frac{7}{32}$	$\frac{1}{2}$	$\frac{5}{32}$	$\frac{5}{16}$	1	\$1 65
$\frac{5}{16}$	$\frac{9}{32}$	$\frac{5}{8}$	$\frac{5}{32}$	$\frac{3}{8}$	1	1 95
$\frac{3}{8}$	$\frac{11}{32}$	$\frac{11}{16}$	$\frac{7}{32}$	$\frac{7}{16}$	2	2 15
$\frac{7}{16}$	$\frac{3}{8}$	$\frac{13}{16}$	$\frac{7}{32}$	$\frac{7}{16}$	2	2 50
$\frac{1}{2}$	$\frac{7}{16}$	$\frac{15}{16}$	$\frac{9}{32}$	$\frac{9}{16}$	2	2 75
$\frac{5}{8}$	$\frac{17}{32}$	$1 \frac{3}{16}$	$\frac{13}{32}$	$\frac{3}{4}$	3	3 25
$\frac{3}{4}$	$\frac{21}{32}$	$1 \frac{5}{16}$	$\frac{17}{32}$	1	3	3 60
$\frac{7}{8}$	$\frac{25}{32}$	$1 \frac{5}{8}$	$\frac{11}{16}$	$1 \frac{1}{16}$	4	3 90
1	$\frac{29}{32}$	$1 \frac{7}{8}$	$\frac{13}{16}$	$1 \frac{3}{16}$	4	4 15

These cutters are made $\frac{1}{32}$ inch larger in diameter and $\frac{1}{64}$ inch greater in thickness than the figures given, to allow for sharpening.

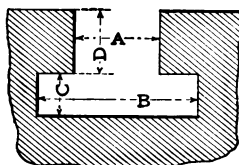
Other sizes made to order.

Standard T Slot Cutters

Brown & Sharpe Taper



Left-hand Cutter



In ordering, state whether right- or left-hand cutters are wanted.

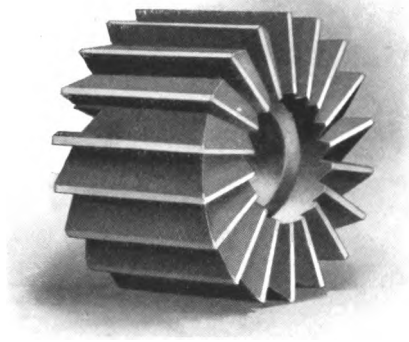
Width of Slot A Inches	Diameter of Neck of Cutter Inches	Width of Slot B Inches	Depth C Inches	Extreme Limit D Inches	No. of Taper Shank	Price Each
$\frac{1}{4}$	$\frac{7}{32}$	$\frac{1}{2}$	$\frac{5}{32}$	$\frac{5}{16}$	4	\$1 50
$\frac{1}{4}$	$\frac{7}{32}$	$\frac{1}{2}$	$\frac{5}{32}$	$\frac{5}{16}$	5	1 60
$\frac{5}{16}$	$\frac{9}{32}$	$\frac{5}{8}$	$\frac{5}{32}$	$\frac{3}{8}$	5	1 80
$\frac{5}{16}$	$\frac{9}{32}$	$\frac{5}{8}$	$\frac{5}{32}$	$\frac{3}{8}$	7	2 10
$\frac{3}{8}$	$\frac{11}{32}$	$\frac{11}{16}$	$\frac{7}{32}$	$\frac{7}{16}$	5	2 00
$\frac{3}{8}$	$\frac{11}{32}$	$\frac{11}{16}$	$\frac{7}{32}$	$\frac{7}{16}$	7	2 20
$\frac{7}{16}$	$\frac{7}{16}$	$\frac{13}{16}$	$\frac{7}{32}$	$\frac{7}{16}$	7	2 35
$\frac{7}{16}$	$\frac{7}{16}$	$\frac{13}{16}$	$\frac{7}{32}$	$\frac{7}{16}$	9	2 50
$\frac{1}{2}$	$\frac{15}{16}$	$\frac{15}{16}$	$\frac{9}{32}$	$\frac{9}{16}$	7	2 60
$\frac{1}{2}$	$\frac{15}{16}$	$\frac{15}{16}$	$\frac{9}{32}$	$\frac{9}{16}$	9	2 80
$\frac{5}{8}$	$\frac{17}{32}$	$1 \frac{3}{16}$	$\frac{13}{32}$	$\frac{3}{4}$	9	3 10
$\frac{3}{4}$	$\frac{33}{64}$	$1 \frac{5}{16}$	$\frac{13}{32}$	1	9	3 45
$\frac{7}{8}$	$\frac{25}{32}$	$1 \frac{5}{8}$	$\frac{11}{16}$	$1 \frac{1}{16}$	9	3 75
1	$\frac{33}{32}$	$1 \frac{7}{8}$	$\frac{13}{16}$	$1 \frac{3}{16}$	9	4 00

These cutters are made $\frac{1}{32}$ inch larger in diameter and $\frac{1}{64}$ inch greater in thickness than the figures given, to allow for sharpening.

Other sizes made to order.

Shell End Mills

Straight or Spiral



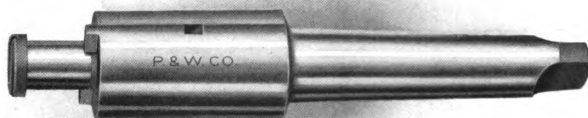
Right-hand Mill

Diameter Inches	Diameter Hole Inches	Length of Cut Inches	Price Each	Diameter Inches	Diameter Hole Inches	Length of Cut Inches	Price Each
1 $\frac{1}{4}$	$\frac{1}{2}$	1 $\frac{1}{4}$	\$1 90	2 $\frac{3}{8}$	$\frac{3}{4}$	2	\$4 75
1 $\frac{5}{8}$	$\frac{1}{2}$	1 $\frac{1}{4}$	2 05	2 $\frac{1}{2}$	$\frac{3}{4}$	2	5 00
1 $\frac{3}{8}$	$\frac{1}{2}$	1 $\frac{1}{4}$	2 20	2 $\frac{5}{8}$	$\frac{3}{4}$	2	5 25
1 $\frac{7}{8}$	$\frac{1}{2}$	1 $\frac{1}{4}$	2 35	2 $\frac{3}{4}$	$\frac{3}{4}$	2	5 50
1 $\frac{1}{2}$	$\frac{3}{8}$	1 $\frac{1}{4}$	2 50	2 $\frac{7}{8}$	$\frac{3}{4}$	2	5 75
1 $\frac{9}{8}$	$\frac{3}{8}$	1 $\frac{1}{4}$	2 65	2 $\frac{1}{2}$	$\frac{3}{4}$	2	6 00
1 $\frac{5}{8}$	$\frac{3}{8}$	1 $\frac{1}{4}$	2 80	2 $\frac{9}{8}$	1	2	6 25
1 $\frac{1}{4}$	$\frac{3}{8}$	1 $\frac{1}{4}$	3 00	2 $\frac{3}{8}$	1	2	6 50
1 $\frac{3}{4}$	$\frac{3}{8}$	1 $\frac{1}{4}$	3 20	2 $\frac{1}{2}$	1	2	6 75
1 $\frac{3}{8}$	$\frac{3}{8}$	1 $\frac{1}{4}$	3 40	2 $\frac{3}{4}$	1	2	7 00
1 $\frac{7}{8}$	$\frac{3}{8}$	1 $\frac{1}{4}$	3 60	2 $\frac{1}{2}$	1	2	7 25
1 $\frac{5}{8}$	$\frac{3}{8}$	1 $\frac{1}{4}$	3 80	2 $\frac{3}{8}$	1	2	7 50
2	$\frac{3}{8}$	1 $\frac{1}{4}$	4 00	2 $\frac{1}{2}$	1	2	7 75
2 $\frac{1}{8}$	$\frac{3}{4}$	2	4 25	3	1	2	8 00
2 $\frac{1}{4}$	$\frac{3}{4}$	2	4 50				

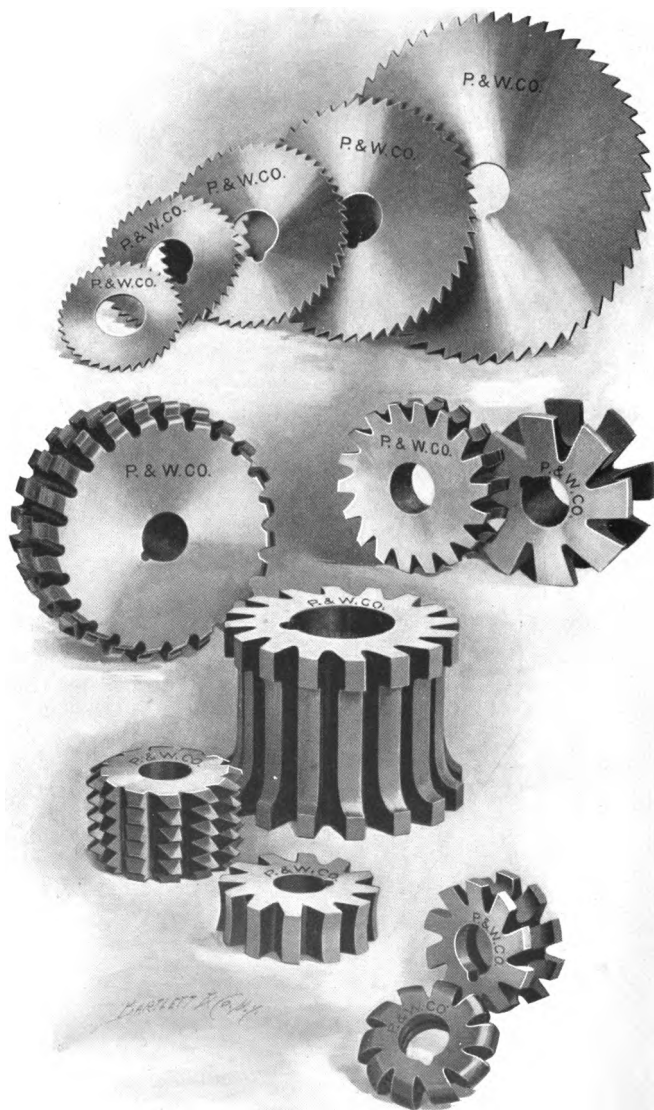
In ordering, state whether right- or left-hand mills are wanted, and whether straight or spiral.

For arbors for these mills see page 97.

Arbors for Shell End Mills



No.	Fitting Sizes Inches	Morse Taper Shank	Price Each
1	$1\frac{1}{4}$ to $1\frac{7}{16}$	No. 3	\$3 75
2	$1\frac{1}{2}$ to 2	3	3 75
3	$2\frac{1}{16}$ to $2\frac{1}{2}$	4	4 00
4	$2\frac{9}{16}$ to 3	4	4 00



H I G H - S P E E D S T E E L C U T T E R S

We are prepared to furnish milling cutters of all types from High-speed Steel on short notice.

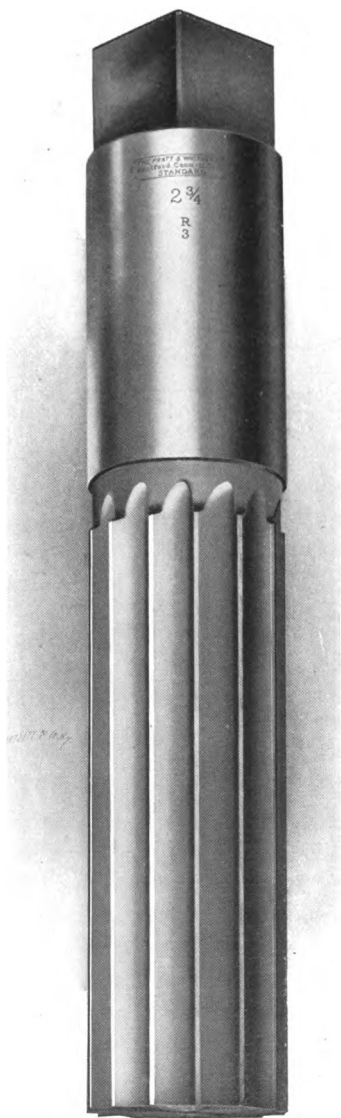
Steel made especially for our own use is furnished in all cutters (unless otherwise specified) and guaranteed by us.

We are also prepared to furnish other tools, such as reamers, twist drills, taps, threading tools, etc., etc., from High-speed Steel.

Prices named on application.

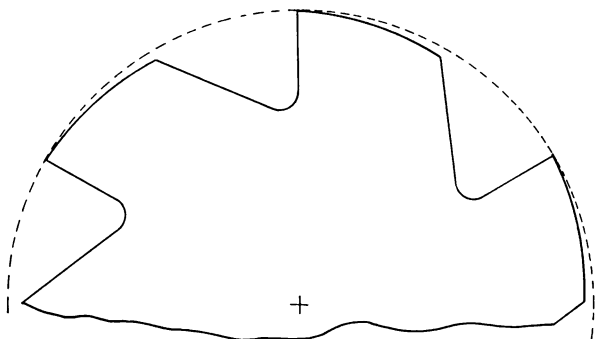
Send for our High-speed Steel Cutter catalog.

Reamer Section

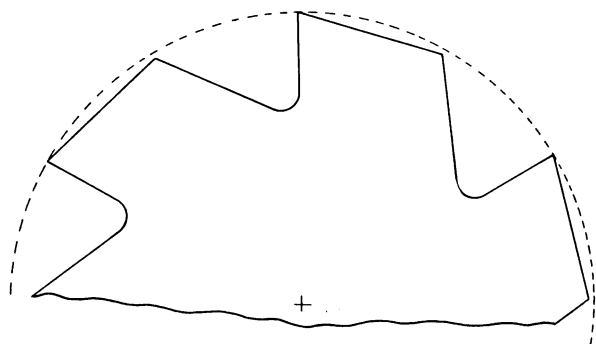


Eccentric Relief Reamers

Process Patented June 9 and 23, 1903



Eccentric Relief



Flat Relief

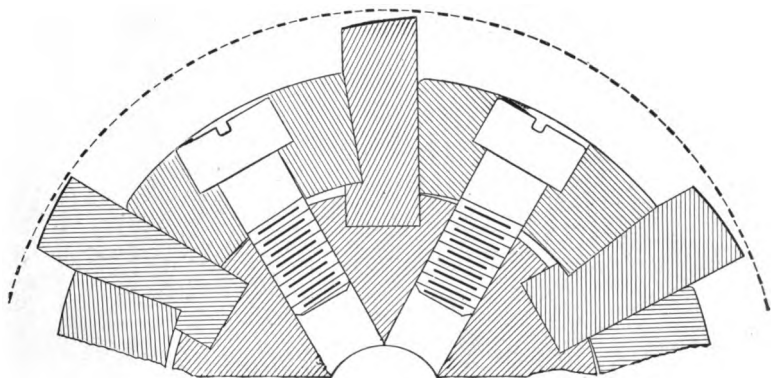
The above cuts show two types of relief, both being exaggerated alike. The upper cut shows our patent eccentric relief, as manufactured by Pratt & Whitney Company. The lower cut shows the flat relief.

The eccentric relieved tooth is stronger. It reams a smoother hole. It does not chatter.

Eccentrically relieved reamers should be sharpened by grinding on the face of each flute, thus retaining a working size for a longer period than would otherwise be possible.

Solid Adjustable Blade Reamers

Patented December 22, 1903



These reamers are made with twelve different sizes of body.

Shell or hand reamers with the same number of body have interchangeable nuts, shoes, screws and wrenches.

All adjustable reamers have eccentric relief, can be set to size without regrinding, and can be made to face the bottom of a hole.

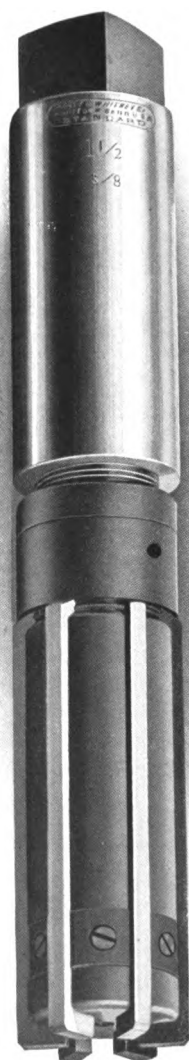
In order to set these reamers to size, it is only necessary to loosen the shoes and run back the nuts. The blades can then be pushed back and the shoes tightened slightly. Then, upon coming up with the adjusting nut, the diameter will gradually decrease till the desired size is obtained, whereupon the lock-nut and shoes should be firmly tightened.

Solid Adjustable Blade Hand Reamers

Patented December 22, 1903

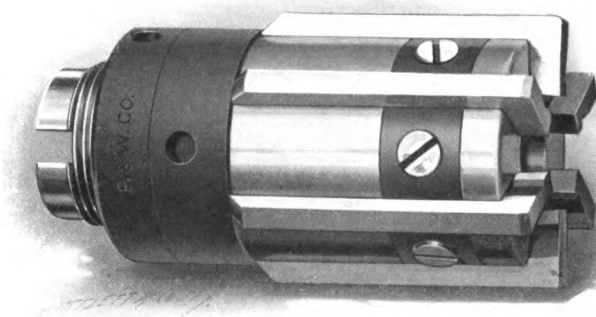
No. of Body	Diameter Inches	Price Each	Total Length Inches
1	$1\frac{3}{16}$	\$7 25	8 $\frac{7}{8}$
	$1\frac{1}{4}$	7 50	8 $\frac{7}{8}$
	$1\frac{5}{8}$	7 75	8 $\frac{7}{8}$
2	$1\frac{3}{8}$	8 00	9 $\frac{3}{4}$
	$1\frac{7}{8}$	9 00	9 $\frac{3}{4}$
	$1\frac{1}{2}$	9 40	9 $\frac{3}{4}$
3	$1\frac{9}{8}$	9 80	10 $\frac{1}{16}$
	$1\frac{5}{8}$	10 20	10 $\frac{1}{16}$
	$1\frac{11}{16}$	10 60	10 $\frac{1}{16}$
4	$1\frac{3}{4}$	11 20	10 $\frac{1}{16}$
	$1\frac{13}{16}$	11 60	11 $\frac{9}{16}$
	$1\frac{7}{8}$	12 00	11 $\frac{9}{16}$
5	$1\frac{15}{16}$	12 40	11 $\frac{9}{16}$
	2	12 80	11 $\frac{9}{16}$
	$2\frac{1}{8}$	13 20	12 $\frac{1}{16}$
6	$2\frac{1}{8}$	13 60	12 $\frac{1}{16}$
	$2\frac{3}{8}$	14 00	12 $\frac{1}{16}$
	$2\frac{1}{4}$	14 40	12 $\frac{1}{16}$
7	$2\frac{5}{8}$	14 80	12 $\frac{9}{16}$
	$2\frac{3}{4}$	15 20	12 $\frac{9}{16}$
	$2\frac{7}{8}$	15 60	12 $\frac{9}{16}$
8	$2\frac{1}{2}$	16 00	12 $\frac{9}{16}$
	$2\frac{9}{16}$	16 50	13 $\frac{1}{16}$
	$2\frac{5}{8}$	17 00	13 $\frac{1}{16}$
	$2\frac{11}{16}$	17 50	13 $\frac{1}{16}$
	$2\frac{3}{4}$	18 00	13 $\frac{1}{16}$
	$2\frac{13}{16}$	18 75	13 $\frac{9}{16}$
	$2\frac{7}{8}$	19 50	13 $\frac{9}{16}$
	$2\frac{15}{16}$	20 25	13 $\frac{9}{16}$
	3	21 00	13 $\frac{9}{16}$

For high power steel blades,
add 25 per cent to list.



Solid Adjustable Blade Shell Reamers

Patented December 22, 1903

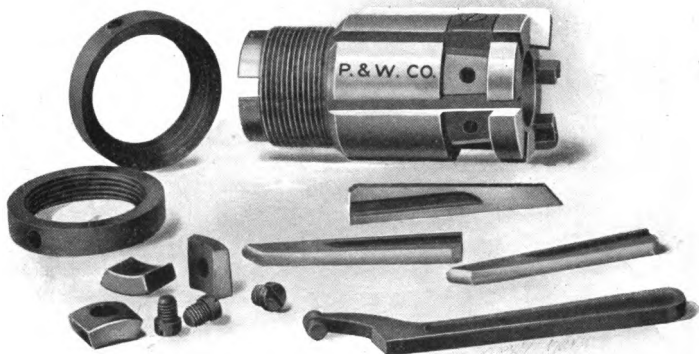


No. of Body	Diam. Inches	Price Each	Takes Arbor No.	Total Length Inches	No. of Body	Diam. Inches	Price Each	Takes Arbor No.	Total Length Inches
1	1 $\frac{3}{16}$	\$6 00	5	3 $\frac{1}{2}$	7	2 $\frac{9}{16}$	\$12 30	9	5 $\frac{3}{8}$
	1 $\frac{1}{4}$	6 00	5	3 $\frac{1}{2}$		2 $\frac{3}{8}$	12 60	9	5 $\frac{3}{8}$
	1 $\frac{5}{16}$	6 30	5	3 $\frac{1}{2}$		2 $\frac{11}{16}$	12 90	9	5 $\frac{3}{8}$
2	1 $\frac{3}{8}$	6 60	6	3 $\frac{3}{4}$	8	2 $\frac{3}{4}$	13 20	9	5 $\frac{3}{8}$
	1 $\frac{7}{16}$	6 90	6	3 $\frac{3}{4}$		2 $\frac{13}{16}$	13 70	9	5 $\frac{1}{2}$
	1 $\frac{1}{2}$	7 20	6	3 $\frac{3}{4}$		2 $\frac{7}{8}$	14 20	9	5 $\frac{1}{2}$
3	1 $\frac{9}{16}$	7 50	6	3 $\frac{3}{4}$	9	2 $\frac{15}{16}$	14 70	9	5 $\frac{1}{2}$
	1 $\frac{5}{8}$	7 80	6	3 $\frac{3}{4}$		3	15 20	9	5 $\frac{1}{2}$
	1 $\frac{11}{16}$	8 10	6	3 $\frac{3}{4}$		3 $\frac{1}{8}$	15 70	10	5 $\frac{11}{16}$
4	1 $\frac{3}{4}$	8 40	6	3 $\frac{3}{4}$	10	3 $\frac{1}{8}$	16 20	10	5 $\frac{11}{16}$
	1 $\frac{7}{8}$	8 70	7	4 $\frac{1}{2}$		3 $\frac{3}{8}$	16 70	10	5 $\frac{11}{16}$
	1 $\frac{1}{2}$	9 00	7	4 $\frac{1}{2}$		3 $\frac{1}{2}$	17 20	10	5 $\frac{11}{16}$
5	2	9 30	7	4 $\frac{3}{4}$	11	3 $\frac{5}{8}$	17 70	10	6
	2 $\frac{1}{8}$	9 60	7	4 $\frac{3}{4}$		3 $\frac{7}{8}$	18 20	10	6
	2 $\frac{1}{4}$	9 90	8	4 $\frac{3}{4}$		3 $\frac{7}{8}$	18 70	10	6
6	2 $\frac{3}{8}$	10 20	8	4 $\frac{3}{4}$	12	3 $\frac{7}{8}$	19 20	10	6
	2 $\frac{1}{2}$	10 50	8	4 $\frac{3}{4}$		3 $\frac{9}{8}$	19 95	11	6 $\frac{1}{4}$
	2 $\frac{5}{8}$	10 80	8	4 $\frac{3}{4}$		3 $\frac{11}{8}$	20 70	11	6 $\frac{1}{4}$
	2 $\frac{3}{4}$	11 10	8	4 $\frac{3}{4}$		3 $\frac{11}{8}$	21 45	11	6 $\frac{1}{4}$
	2 $\frac{7}{8}$	11 40	8	4 $\frac{3}{4}$		3 $\frac{13}{8}$	22 20	11	6 $\frac{1}{4}$
	2 $\frac{1}{2}$	11 70	8	4 $\frac{3}{4}$		3 $\frac{13}{8}$	22 95	11	6 $\frac{9}{16}$
		12 00	8	4 $\frac{3}{4}$		3 $\frac{7}{8}$	23 70	11	6 $\frac{9}{16}$
						3 $\frac{15}{8}$	24 45	11	6 $\frac{9}{16}$
						4	25 20	11	6 $\frac{9}{16}$

For high power steel blades, add 25 per cent to list.

Parts of Solid Adjustable Blade Reamers

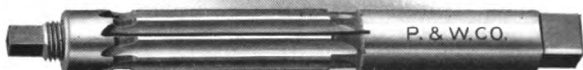
Patented December 22, 1903



Prices of Parts of Adjustable Reamers

No. of Body	Hand		Shell		Adjust- ing Nut	Lock Nut	Shoes per Set	Screws per Set	Spanner Wrench
	Body	Blades	Body	Blades					
1	\$3 00	\$2 50	\$2 00	\$2 00	\$1 20	\$0 40	\$0 50	\$0 20	\$0 45
2	3 75	3 00	2 25	2 25	1 35	50	60	20	45
3	4 70	3 50	2 90	2 50	1 50	55	70	25	45
4	5 25	4 00	3 30	2 75	1 75	75	80	25	60
5	5 80	4 50	3 70	3 00	1 95	90	95	30	60
6	6 65	5 00	4 25	3 40	2 05	1 00	1 00	30	60
7	7 80	5 50	4 50	4 00	2 20	1 10	1 10	30	75
8	9 20	6 00	4 95	4 50	2 65	1 35	1 25	50	75
9	....	....	5 65	5 25	3 00	1 45	1 30	55	75
10	....	....	6 35	6 00	3 35	1 50	1 40	60	90
11	....	....	8 05	6 75	3 70	1 60	1 45	65	90
12	....	....	9 70	7 50	4 10	1 70	1 50	70	90

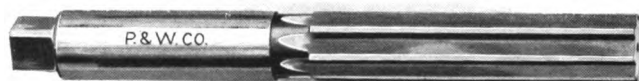
Expansion Reamers



Diameter Inches	Price Each	Total Length Inches	Length of Flute Inches
$\frac{1}{4}$	\$3 00	4	$1\frac{1}{2}$
$\frac{5}{16}$	3 05	4	$1\frac{1}{2}$
$\frac{3}{8}$	3 10	4	$1\frac{1}{2}$
$\frac{7}{16}$	3 15	5	$1\frac{3}{4}$
$\frac{1}{2}$	3 20	5	$1\frac{3}{4}$
$\frac{9}{16}$	3 25	5	$1\frac{3}{4}$
$\frac{5}{8}$	3 30	5	$1\frac{3}{4}$
$\frac{11}{16}$	3 35	6	$2\frac{1}{4}$
$\frac{3}{4}$	3 40	6	$2\frac{1}{4}$
$\frac{13}{16}$	3 65	6	$2\frac{1}{4}$
$\frac{7}{8}$	4 00	6	$2\frac{1}{4}$
$\frac{15}{16}$	4 40	7	$2\frac{3}{8}$
1	4 80	7	$2\frac{3}{8}$
$1\frac{1}{16}$	5 25	7	$2\frac{3}{8}$
$1\frac{1}{8}$	5 75	8	$3\frac{1}{8}$
	6 25	8	$3\frac{1}{8}$
	6 75	8	$3\frac{1}{8}$
	6 90	9	$3\frac{9}{16}$
	7 40	9	$3\frac{9}{16}$

Standard Hand Reamers

Process Patented June 9 and 23, 1903



Diameter Inches	Price Each	Length of Flute Inches	Total Length Inches	Diameter Inches	Price Each	Length of Flute Inches	Total Length Inches
1/8	\$1 00	1 3/16	2 1/2	1 5/32	\$4 45	5	9 5/8
5/32	1 10	1 5/16	2 3/4	1 11/16	4 60	5 1/16	9 3/4
3/16	1 20	1 7/16	3	1 3/2	4 75	5 1/8	9 7/8
7/32	1 30	1 5/8	3 1/4	1 1/2	4 90	5 1/4	10
1/4	1 40	1 3/8	3 1/2	1 5/8	5 05	5 3/8	10 1/8
9/32	1 45	2	3 3/4	1 11/16	5 20	5 5/16	10 1/4
5/16	1 50	2 1/8	4	1 3/4	5 40	5 7/16	10 3/8
11/32	1 55	2 1/4	4 1/4	1 3/8	5 60	5 5/8	10 1/2
3/8	1 60	2 3/8	4 1/2	1 13/32	5 80	5 11/16	10 5/8
13/32	1 70	2 1/2	4 3/4	1 7/8	6 00	5 13/16	10 3/4
7/16	1 75	2 5/8	5	1 15/16	6 20	5 7/8	10 7/8
15/32	1 85	2 3/4	5 1/4	1 3/2	6 40	6	11
1/2	1 90	2 7/8	5 1/2	1 17/32	6 60	6 1/16	11 1/8
9/16	1 95	3	5 3/4	1 9/16	6 80	6 3/16	11 1/4
5/8	2 00	3 1/8	6	1 19/32	7 00	6 1/2	11 3/8
11/16	2 10	3 1/4	6 1/4	1 3/2	7 20	6 3/8	11 1/2
3/4	2 20	3 3/8	6 1/2	1 21/32	7 40	6 7/16	11 5/8
7/8	2 30	3 1/2	6 3/4	1 11/16	7 60	6 1/2	11 3/4
15/16	2 40	3 5/8	7	1 23/32	7 80	6 3/8	11 7/8
1	2 50	3 3/4	7 1/4	1 3/4	8 00	6 5/8	12
1 1/8	2 60	3 7/8	7 1/2	1 25/32	8 20	6 11/16	12 1/8
1 1/4	2 70	4	7 1/4	1 13/16	8 40	6 3/4	12 1/4
1 1/2	2 80	4 1/8	7 7/8	1 7/8	8 60	6 13/16	12 3/8
1 3/4	2 95	4 1/4	8 1/8	1 3/2	8 80	6 7/8	12 1/2
1 7/8	3 10	4 3/8	8 1/4	1 29/32	9 00	6 13/16	12 5/8
2	3 25	4 1/2	8 1/2	1 31/32	9 20	7	12 3/4
2 1/8	3 40	4 5/8	8 5/8	2	9 40	7	12 7/8
2 1/4	3 55	4 3/4	8 3/4	2 1/16	9 60	7 1/16	13
2 1/2	3 70	4 7/8	9	2 1/8	10 00	7 1/8	13 1/8
2 3/4	3 85	4 15/16	9 1/8	2 3/16	10 40	7 3/16	13 1/4
3	4 00	4 3/4	9 1/4	2 1/2	10 80	7 1/2	13 3/8
3 1/8	4 15	4 13/16	9 3/8	2 5/16	11 30	7 5/16	13 1/2
3 1/4	4 30	4 7/8	9 1/2	2 3/8	11 80	7 3/8	13 5/8

Standard Hand Reamers—*Continued*

Diameter Inches	Price Each	Length of Flute Inches	Total Length Inches	Diameter Inches	Price Each	Length of Flute Inches	Total Length Inches
$2\frac{3}{8}$	\$12 30	$7\frac{7}{8}$	$13\frac{3}{4}$	$2\frac{3}{4}$	\$16 20	$7\frac{1}{2}$	$14\frac{1}{2}$
$2\frac{7}{8}$	12 80	$7\frac{1}{2}$	$13\frac{3}{8}$	$2\frac{1}{2}$	17 00	$7\frac{3}{8}$	$14\frac{3}{8}$
$2\frac{1}{2}$	13 40	$7\frac{5}{8}$	14	$2\frac{1}{8}$	17 80	$7\frac{1}{8}$	$14\frac{1}{8}$
$2\frac{9}{16}$	14 00	$7\frac{5}{8}$	$14\frac{1}{8}$	$2\frac{1}{16}$	18 60	8	$14\frac{7}{8}$
$2\frac{5}{8}$	14 60	$7\frac{1}{8}$	$14\frac{1}{4}$	3	19 40	$8\frac{1}{16}$	15
$2\frac{1}{16}$	15 40	$7\frac{3}{4}$	$14\frac{3}{8}$				

Prices of sixty-fourth sizes intermediate, same as next size larger.

Reamers with threaded end furnished at same list prices as above.

Hand Reamers

In Hardwood Case

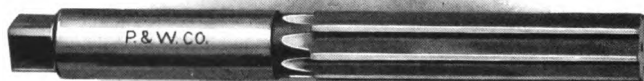


Prices of Hand Reamers, Per Set

Set, $\frac{1}{4}$ to 1 inch in diameter, by 16ths.....	\$30 00
Set, $\frac{1}{4}$ to $1\frac{1}{4}$ inches in diameter, by 16ths.....	48 00
Set, $\frac{1}{4}$ to $1\frac{1}{2}$ inches in diameter, by 16ths.....	70 00
Set, $\frac{1}{4}$ to 2 inches in diameter, by 16ths.....	135 00
Set, $\frac{1}{4}$ to 1 inch in diameter, by 32ds.....	57 50
Set, $\frac{1}{4}$ to $1\frac{1}{4}$ inches in diameter, by 32ds.....	92 00
Set, $\frac{1}{4}$ to $1\frac{1}{2}$ inches in diameter, by 32ds.....	137 00
Set, $\frac{1}{4}$ to 2 inches in diameter, by 32ds.....	265 00

Hand Reamers—Short Set

Process Patented June 9 and 23, 1903



Diameter Inches	Price Each	Length of Flute Inches	Total Length Inches	Diameter Inches	Price Each	Length of Flute Inches	Total Length Inches
1/4	\$1 30	2 1/8	3 3/4	1 3/32	\$4 20	5 1/8	9 1/2
3/8	1 35	2 1/8	3 3/8	1 1/8	4 35	5 1/4	9 3/4
1/2	1 40	2 1/4	4	1 1/16	4 50	5 3/8	9 7/8
5/8	1 45	2 1/4	4 1/8	1 1/2	4 70	5 1/2	10
3/4	1 50	2 3/8	4 1/4	1 5/8	4 95	5 1/2	10 1/8
7/8	1 55	2 1/2	4 3/8	1 3/4	5 20	5 5/8	10 1/4
1	1 60	2 1/2	4 1/2	1 7/8	5 45	5 5/8	10 3/8
1 1/8	1 65	2 1/2	4 5/8	1 5/8	5 70	5 3/4	10 1/2
1 1/4	1 70	2 3/4	4 3/4	1 3/2	5 95	5 3/4	10 5/8
1 1/2	1 75	2 3/4	4 7/8	1 1/2	6 20	5 5/8	10 3/4
1 3/4	1 80	2 5/8	5	1 1/2	6 45	5 7/8	10 7/8
1 5/8	1 85	2 5/8	5 1/8	1 3/4	6 70	6	11
1 7/8	1 90	2 5/8	5 1/4	1 3/4	6 95	6	11 1/8
2	1 95	2 3/4	5 3/8	1 3/4	7 10	6 1/8	11 1/4
2 1/8	2 05	2 3/4	5 1/2	1 3/4	7 30	6 1/8	11 3/8
2 1/4	2 15	2 7/8	5 5/8	1 3/4	7 50	6 1/4	11 1/2
2 1/2	2 20	3	5 3/4	1 3/4	7 70	6 1/4	11 5/8
2 3/4	2 30	3	5 7/8	1 3/4	7 90	6 3/8	11 3/4
2 5/8	2 35	3 1/8	6	1 3/4	8 10	6 3/8	11 7/8
2 7/8	2 40	3 1/8	6 1/4	2	8 30	6 1/2	12
3	2 50	3 1/4	6 3/8	2	8 70	6 1/2	12 1/8
3 1/8	2 60	3 3/8	6 1/2	2 1/8	9 10	6 5/8	12 1/4
3 1/4	2 70	3 7/8	6 3/4	2 1/8	9 50	6 5/8	12 3/8
3 1/2	2 80	3 1/2	7	2 1/8	9 90	6 3/4	12 1/2
3 3/4	2 90	3 5/8	7 1/8	2 1/8	10 30	6 3/4	12 5/8
3 5/8	3 00	3 5/8	7 1/4	2 1/8	10 80	6 7/8	12 3/4
3 7/8	3 10	3 3/4	7 1/2	2 1/8	11 40	7	12 7/8
4	3 20	3 7/8	7 3/4	2 1/2	12 00	7	13
4 1/8	3 30	4	7 7/8	2 1/2	12 60	7 1/8	13 1/8
4 1/4	3 40	4 1/8	8	2 1/2	13 20	7 1/8	13 1/4
4 1/2	3 50	4 1/4	8 1/4	2 1/2	13 85	7 1/4	13 3/8
4 3/4	3 60	4 3/8	8 1/2	2 3/4	14 50	7 1/4	13 1/2
4 5/8	3 70	4 1/2	8 5/8	2 3/4	15 20	7 3/8	13 5/8
4 3/4	3 80	4 5/8	8 3/4	2 3/4	15 95	7 3/8	13 3/4
4 7/8	3 90	4 3/4	9	2 3/4	16 70	7 1/2	13 7/8
5	4 00	4 7/8	9 1/4	3	17 50	7 1/2	14
5 1/8	4 10	5	9 3/8				

Reamers with threaded end furnished at same list prices as above.

When ordering these reamers, always specify *Short Set*, otherwise standard hand reamers will be furnished.

Jobbers' Reamers, with Morse Taper Shanks

Process Patented June 9 and 23, 1903

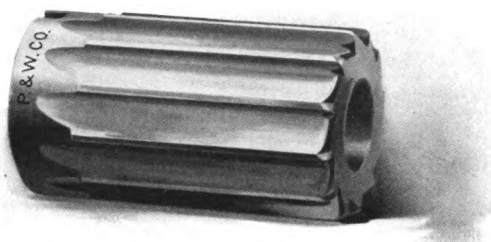


Diam. Inches	Price Each	Total Length Inches	Length of Flute Inches	No. of Morse Taper Shank	Diam. Inches	Price Each	Total Length Inches	Length of Flute Inches	No. of Morse Taper Shank
$\frac{1}{4}$	\$1 50	$5\frac{3}{16}$	2	No. 1	$1\frac{13}{32}$	\$5 90	$12\frac{13}{16}$	$6\frac{5}{16}$	No. 4
$\frac{3}{8}$	1 55	$5\frac{3}{16}$	2		$1\frac{7}{16}$	6 10	13	$6\frac{7}{16}$	
$\frac{1}{2}$	1 60	$5\frac{1}{2}$	$2\frac{1}{4}$		$1\frac{5}{8}$	6 30	13	$6\frac{7}{16}$	
$\frac{5}{8}$	1 65	$5\frac{1}{2}$	$2\frac{1}{4}$		$1\frac{3}{2}$	6 50	$13\frac{1}{8}$	$6\frac{1}{2}$	
$\frac{3}{4}$	1 70	$5\frac{13}{16}$	$2\frac{1}{2}$		$1\frac{7}{8}$	6 70	$13\frac{1}{8}$	$6\frac{1}{2}$	
$\frac{7}{8}$	1 80	$5\frac{13}{16}$	$2\frac{1}{2}$		$1\frac{9}{8}$	6 90	$13\frac{1}{8}$	$6\frac{1}{2}$	
1	1 85	$6\frac{1}{8}$	$2\frac{3}{4}$		$1\frac{5}{4}$	7 10	$13\frac{1}{8}$	$6\frac{1}{2}$	
$1\frac{1}{8}$	1 95	$6\frac{1}{8}$	$2\frac{3}{4}$		$1\frac{3}{2}$	7 30	$13\frac{1}{8}$	$6\frac{1}{2}$	
$1\frac{1}{4}$	2 00	$6\frac{7}{16}$	3		$1\frac{13}{16}$	7 50	$13\frac{1}{8}$	$6\frac{1}{2}$	
$1\frac{1}{2}$	2 10	$6\frac{7}{16}$	3		$1\frac{11}{8}$	7 70	$13\frac{3}{8}$	$6\frac{3}{4}$	
$1\frac{3}{4}$	2 15	$6\frac{3}{4}$	$3\frac{1}{4}$		$1\frac{23}{16}$	7 85	$13\frac{3}{8}$	$6\frac{3}{4}$	
2	2 25	$6\frac{3}{4}$	$3\frac{1}{4}$		$1\frac{7}{8}$	8 00	$14\frac{1}{8}$	$6\frac{3}{4}$	
$2\frac{1}{8}$	2 30	$7\frac{9}{16}$	$3\frac{1}{2}$		$1\frac{25}{16}$	8 20	$14\frac{1}{16}$	$6\frac{3}{4}$	
$2\frac{1}{4}$	2 40	$7\frac{9}{16}$	$3\frac{1}{2}$		$1\frac{13}{8}$	8 40	$14\frac{1}{16}$	$6\frac{3}{4}$	
$2\frac{1}{2}$	2 50	8	$3\frac{3}{8}$		$1\frac{27}{16}$	8 60	$14\frac{1}{16}$	$6\frac{3}{4}$	
$2\frac{3}{4}$	2 60	8	$3\frac{3}{8}$		$1\frac{7}{8}$	8 80	15	7	
3	2 70	$8\frac{3}{8}$	$4\frac{3}{16}$	No. 2	$1\frac{29}{16}$	9 00	15	7	No. 5
$3\frac{1}{8}$	2 80	$8\frac{3}{8}$	$4\frac{3}{16}$		$1\frac{15}{8}$	9 20	15	7	
$3\frac{1}{4}$	2 90	$8\frac{13}{16}$	$4\frac{9}{16}$		$1\frac{31}{16}$	9 40	15	7	
$3\frac{1}{2}$	3 05	$8\frac{13}{16}$	$4\frac{9}{16}$		2	9 60	15	7	
$3\frac{3}{4}$	3 20	$9\frac{3}{16}$	$4\frac{7}{8}$		$2\frac{1}{16}$	10 00	$15\frac{1}{2}$	$7\frac{1}{4}$	
4	3 35	$9\frac{3}{16}$	$4\frac{7}{8}$		$2\frac{3}{16}$	10 40	$15\frac{1}{2}$	$7\frac{1}{4}$	
$4\frac{1}{8}$	3 50	10	$5\frac{1}{8}$		$2\frac{5}{16}$	10 80	$15\frac{1}{2}$	$7\frac{1}{4}$	
$4\frac{1}{4}$	3 65	10	$5\frac{1}{8}$		$2\frac{7}{16}$	11 30	$15\frac{1}{2}$	$7\frac{1}{4}$	
$4\frac{1}{2}$	3 80	$10\frac{3}{8}$	$5\frac{7}{16}$		$2\frac{9}{16}$	11 80	16	$7\frac{1}{2}$	
$4\frac{3}{4}$	3 95	$10\frac{3}{8}$	$5\frac{7}{16}$		$2\frac{11}{16}$	12 30	16	$7\frac{1}{2}$	
5	4 10	$10\frac{5}{8}$	$5\frac{5}{8}$	No. 3	$2\frac{13}{16}$	12 80	16	$7\frac{1}{2}$	No. 5
$5\frac{1}{8}$	4 25	$10\frac{5}{8}$	$5\frac{5}{8}$		$2\frac{15}{16}$	13 40	16	$7\frac{1}{2}$	
$5\frac{1}{4}$	4 40	$10\frac{7}{8}$	$5\frac{5}{8}$		$2\frac{17}{16}$	14 00	$16\frac{1}{2}$	$7\frac{3}{4}$	
$5\frac{1}{2}$	4 55	$10\frac{7}{8}$	$5\frac{13}{16}$		$2\frac{19}{16}$	14 60	$16\frac{1}{2}$	$7\frac{3}{4}$	
$5\frac{3}{4}$	4 70	$11\frac{1}{8}$	6		$2\frac{21}{16}$	15 40	$16\frac{1}{2}$	$7\frac{3}{4}$	
6	4 85	$11\frac{1}{8}$	6		$2\frac{23}{16}$	16 20	$16\frac{1}{2}$	$7\frac{3}{4}$	
$6\frac{1}{8}$	5 00	$12\frac{9}{16}$	$6\frac{1}{8}$		$2\frac{25}{16}$	17 00	17	8	
$6\frac{1}{4}$	5 15	$12\frac{9}{16}$	$6\frac{1}{8}$		$2\frac{27}{16}$	17 80	17	8	
$6\frac{3}{8}$	5 30	$12\frac{11}{16}$	$6\frac{1}{4}$	No. 4	$2\frac{29}{16}$	18 60	17	8	No. 5
$6\frac{1}{2}$	5 50	$12\frac{11}{16}$	$6\frac{1}{4}$		$2\frac{31}{16}$	19 40	17	8	
$6\frac{5}{8}$	5 70	$12\frac{13}{16}$	$6\frac{5}{8}$		3				

Reamers of any style, size, or length, made to order. Flutes straight or spiral, as desired.

Standard Shell Reamers

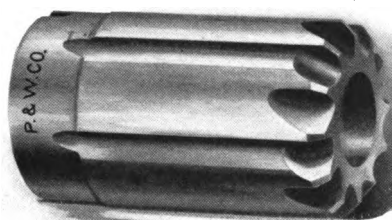
Process Patented June 9 and 23, 1903



Diameter Inches	Diameter Hole Large End Inches	Price Each	Total Length Inches	Diameter Inches	Diameter Hole Large End Inches	Price Each	Total Length Inches
$\frac{1}{4}$	$\frac{1}{8}$	\$1 10	1 $\frac{1}{2}$	$2\frac{3}{16}$	$1\frac{1}{4}$	\$5 80	3 $\frac{3}{4}$
$\frac{5}{16}$	$\frac{1}{8}$	1 10	1 $\frac{1}{2}$	$2\frac{1}{4}$	$1\frac{1}{4}$	6 00	3 $\frac{3}{4}$
$\frac{3}{8}$	$\frac{1}{8}$	1 20	1 $\frac{3}{4}$	$2\frac{5}{16}$	$1\frac{1}{4}$	6 20	3 $\frac{3}{4}$
$\frac{7}{16}$	$\frac{1}{8}$	1 30	1 $\frac{3}{4}$	$2\frac{3}{8}$	$1\frac{1}{4}$	6 40	3 $\frac{3}{4}$
$\frac{1}{2}$	$\frac{1}{4}$	1 40	2	$2\frac{7}{16}$	$1\frac{1}{4}$	6 60	3 $\frac{3}{4}$
$\frac{9}{16}$	$\frac{1}{4}$	1 50	2	$2\frac{1}{2}$	$1\frac{1}{4}$	6 80	3 $\frac{3}{4}$
$\frac{5}{8}$	$\frac{3}{8}$	1 60	2 $\frac{1}{4}$	$2\frac{9}{16}$	$1\frac{1}{2}$	7 00	4
$\frac{11}{16}$	$\frac{3}{8}$	1 60	2 $\frac{1}{4}$	$2\frac{5}{8}$	$1\frac{1}{2}$	7 30	4
$\frac{3}{4}$	$\frac{1}{2}$	1 60	2 $\frac{1}{2}$	$2\frac{11}{16}$	$1\frac{1}{2}$	7 60	4
$\frac{7}{8}$	$\frac{1}{2}$	1 60	2 $\frac{1}{2}$	$2\frac{3}{4}$	$1\frac{1}{2}$	8 00	4
$1\frac{1}{8}$	$\frac{1}{2}$	1 70	2 $\frac{1}{2}$	$2\frac{13}{16}$	$1\frac{1}{2}$	8 40	4
1	$\frac{1}{2}$	1 70	2 $\frac{1}{2}$	$2\frac{7}{8}$	$1\frac{1}{2}$	8 80	4
$1\frac{1}{16}$	$\frac{5}{8}$	1 80	2 $\frac{3}{4}$	$2\frac{15}{16}$	$1\frac{1}{2}$	9 20	4
$1\frac{1}{8}$	$\frac{5}{8}$	1 80	2 $\frac{3}{4}$	3	$1\frac{1}{2}$	9 60	4
$1\frac{1}{4}$	$\frac{5}{8}$	1 90	2 $\frac{3}{4}$	$3\frac{1}{16}$	$1\frac{3}{4}$	9 90	4 $\frac{1}{2}$
$1\frac{3}{8}$	$\frac{5}{8}$	2 00	2 $\frac{3}{4}$	$3\frac{1}{8}$	$1\frac{3}{4}$	10 20	4 $\frac{1}{2}$
$1\frac{1}{2}$	$\frac{5}{8}$	2 20	2 $\frac{3}{4}$	$3\frac{3}{16}$	$1\frac{3}{4}$	10 60	4 $\frac{1}{2}$
$1\frac{5}{8}$	$\frac{3}{4}$	2 40	3	$3\frac{1}{4}$	$1\frac{3}{4}$	11 00	4 $\frac{1}{2}$
$1\frac{3}{4}$	$\frac{3}{4}$	2 60	3	$3\frac{5}{16}$	$1\frac{3}{4}$	11 50	4 $\frac{1}{2}$
$1\frac{7}{8}$	$\frac{3}{4}$	2 80	3	$3\frac{3}{8}$	$1\frac{3}{4}$	12 00	4 $\frac{1}{2}$
$1\frac{1}{2}$	$\frac{3}{4}$	3 00	3	$3\frac{7}{16}$	$1\frac{3}{4}$	12 50	4 $\frac{1}{2}$
$1\frac{9}{16}$	$\frac{3}{4}$	3 20	3	$3\frac{1}{2}$	$1\frac{3}{4}$	13 00	4 $\frac{1}{2}$
$1\frac{5}{8}$	$\frac{3}{4}$	3 50	3	$3\frac{5}{8}$	2	13 50	5
$1\frac{11}{16}$	1	3 80	3 $\frac{1}{2}$	$3\frac{5}{16}$	2	14 00	5
$1\frac{3}{4}$	1	4 10	3 $\frac{1}{2}$	$3\frac{11}{16}$	2	14 50	5
$1\frac{13}{16}$	1	4 40	3 $\frac{1}{2}$	$3\frac{3}{4}$	2	15 00	5
$1\frac{7}{8}$	1	4 70	3 $\frac{1}{2}$	$3\frac{7}{8}$	2	15 50	5
$1\frac{15}{16}$	1	5 00	3 $\frac{1}{2}$	$3\frac{15}{16}$	2	16 00	5
2	1	5 20	3 $\frac{1}{2}$	4	2	17 00	5
$2\frac{1}{16}$	$1\frac{1}{4}$	5 40	3 $\frac{3}{4}$			18 00	5
$2\frac{1}{8}$	$1\frac{1}{4}$	5 60	3 $\frac{3}{4}$				

Prices of standard shell reamers to 6 inches quoted upon application.

Standard Rose Shell Reamers



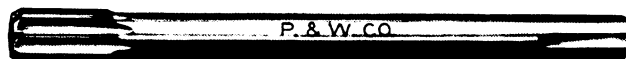
Diameter Inches	Diameter Hole Large End Inches	Price Each	Total Length Inches	Diameter Inches	Diameter Hole Large End Inches	Price Each	Total Length Inches
$\frac{1}{4}$	$\frac{1}{8}$	\$1 10	1 $\frac{1}{2}$	$2\frac{3}{16}$	$1\frac{1}{4}$	\$5 80	3 $\frac{3}{4}$
$\frac{5}{16}$	$\frac{1}{8}$	1 10	1 $\frac{1}{2}$	$2\frac{1}{4}$	$1\frac{1}{4}$	6 00	3 $\frac{3}{4}$
$\frac{3}{8}$	$\frac{3}{16}$	1 20	1 $\frac{3}{4}$	$2\frac{5}{16}$	$1\frac{1}{4}$	6 20	3 $\frac{3}{4}$
$\frac{7}{16}$	$\frac{1}{4}$	1 30	1 $\frac{3}{4}$	$2\frac{3}{8}$	$1\frac{1}{4}$	6 40	3 $\frac{3}{4}$
$\frac{1}{2}$	$\frac{1}{4}$	1 40	2	$2\frac{7}{16}$	$1\frac{1}{4}$	6 60	3 $\frac{3}{4}$
$\frac{9}{16}$	$\frac{3}{8}$	1 50	2	$2\frac{1}{2}$	$1\frac{1}{4}$	6 80	3 $\frac{3}{4}$
$\frac{5}{8}$	$\frac{3}{8}$	1 60	2 $\frac{1}{4}$	$2\frac{9}{16}$	$1\frac{1}{2}$	7 00	4
$\frac{11}{16}$	$\frac{3}{8}$	1 60	2 $\frac{1}{4}$	$2\frac{5}{8}$	$1\frac{1}{2}$	7 30	4
$\frac{3}{4}$	$\frac{1}{2}$	1 60	2 $\frac{1}{2}$	$2\frac{11}{16}$	$1\frac{1}{2}$	7 60	4
$\frac{7}{8}$	$\frac{1}{2}$	1 60	2 $\frac{1}{2}$	$2\frac{3}{4}$	$1\frac{1}{2}$	8 00	4
$\frac{15}{16}$	$\frac{1}{2}$	1 70	2 $\frac{1}{2}$	$2\frac{13}{16}$	$1\frac{1}{2}$	8 40	4
1	$\frac{1}{2}$	1 70	2 $\frac{1}{2}$	$2\frac{7}{8}$	$1\frac{1}{2}$	8 80	4
$1\frac{1}{16}$	$\frac{5}{8}$	1 80	2 $\frac{3}{4}$	$2\frac{15}{16}$	$1\frac{1}{2}$	9 20	4
$1\frac{1}{8}$	$\frac{5}{8}$	1 80	2 $\frac{3}{4}$	3	$1\frac{1}{2}$	9 60	4
$1\frac{1}{4}$	$\frac{5}{8}$	1 90	2 $\frac{3}{4}$	$3\frac{1}{16}$	$1\frac{3}{4}$	9 90	4 $\frac{1}{2}$
$1\frac{3}{8}$	$\frac{5}{8}$	2 00	2 $\frac{3}{4}$	$3\frac{1}{8}$	$1\frac{3}{4}$	10 20	4 $\frac{1}{2}$
$1\frac{1}{2}$	$\frac{5}{8}$	2 20	2 $\frac{3}{4}$	$3\frac{3}{8}$	$1\frac{3}{4}$	10 60	4 $\frac{1}{2}$
$1\frac{5}{8}$	$\frac{3}{4}$	2 40	3	$3\frac{1}{2}$	$1\frac{3}{4}$	11 00	4 $\frac{1}{2}$
$1\frac{3}{4}$	$\frac{3}{4}$	2 60	3	$3\frac{5}{8}$	$1\frac{3}{4}$	11 50	4 $\frac{1}{2}$
$1\frac{7}{8}$	$\frac{3}{4}$	2 80	3	$3\frac{3}{4}$	$1\frac{3}{4}$	12 00	4 $\frac{1}{2}$
$1\frac{1}{2}$	$\frac{3}{4}$	3 00	3	$3\frac{7}{8}$	$1\frac{3}{4}$	12 50	4 $\frac{1}{2}$
$1\frac{9}{16}$	$\frac{3}{4}$	3 20	3	$3\frac{1}{2}$	$1\frac{3}{4}$	13 00	4 $\frac{1}{2}$
$1\frac{5}{8}$	$\frac{3}{4}$	3 50	3	$3\frac{9}{16}$	2	13 50	5
$1\frac{11}{16}$	1	3 80	3 $\frac{1}{2}$	$3\frac{5}{8}$	2	14 00	5
$1\frac{3}{4}$	1	4 10	3 $\frac{1}{2}$	$3\frac{11}{16}$	2	14 50	5
$1\frac{7}{8}$	1	4 40	3 $\frac{1}{2}$	$3\frac{3}{4}$	2	15 00	5
$1\frac{15}{16}$	1	4 70	3 $\frac{1}{2}$	$3\frac{13}{16}$	2	15 50	5
2	1	5 00	3 $\frac{1}{2}$	$3\frac{7}{8}$	2	16 00	5
$2\frac{1}{16}$	$1\frac{1}{4}$	5 20	3 $\frac{1}{2}$	$3\frac{15}{16}$	2	17 00	5
$2\frac{1}{8}$	$1\frac{1}{4}$	5 60	3 $\frac{3}{4}$	4	2	18 00	5

Prices of standard rose shell reamers to 6 inches quoted upon application.

Fluted Chucking Reamers

Process Patented June 9 and 23, 1903

Straight Shank for Screw and Chucking Machine



These reamers can be furnished .004 to .010 inch under size, at regular prices.

Diameter Inches	Price Each	Length of Flute Inches	Total Length Inches	Diameter Inches	Price Each	Length of Flute Inches	Total Length Inches
$\frac{1}{4}$	\$0 90	1	6	$1\frac{11}{16}$	\$4 00	$2\frac{1}{2}$	$13\frac{1}{4}$
$\frac{5}{16}$	1 00	1	6	$1\frac{3}{4}$	4 20	$2\frac{5}{8}$	$13\frac{3}{4}$
$\frac{3}{8}$	1 10	$1\frac{1}{8}$	7	$1\frac{7}{8}$	4 40	$2\frac{5}{8}$	$13\frac{3}{4}$
$\frac{7}{16}$	1 20	$1\frac{1}{8}$	7	$1\frac{7}{8}$	4 60	$2\frac{3}{4}$	$14\frac{1}{4}$
$\frac{1}{2}$	1 30	$1\frac{1}{4}$	$8\frac{1}{8}$	$1\frac{5}{8}$	4 80	$2\frac{3}{4}$	$14\frac{1}{4}$
$\frac{9}{16}$	1 40	$1\frac{1}{4}$	$8\frac{1}{8}$	2	5 00	$2\frac{3}{4}$	$14\frac{1}{4}$
$\frac{5}{8}$	1 50	$1\frac{3}{8}$	$9\frac{1}{8}$	$2\frac{1}{8}$	5 30	$2\frac{7}{8}$	$14\frac{3}{4}$
$1\frac{1}{16}$	1 60	$1\frac{3}{8}$	$9\frac{1}{8}$	$2\frac{1}{8}$	5 60	$2\frac{7}{8}$	$14\frac{3}{4}$
$\frac{3}{4}$	1 70	$1\frac{1}{2}$	$9\frac{5}{8}$	$2\frac{3}{8}$	5 90	$2\frac{7}{8}$	$14\frac{3}{4}$
$1\frac{1}{8}$	1 85	$1\frac{1}{2}$	$9\frac{5}{8}$	$2\frac{1}{4}$	6 20	3	$15\frac{1}{4}$
$\frac{7}{8}$	2 00	$1\frac{3}{4}$	$10\frac{1}{4}$	$2\frac{5}{8}$	6 50	3	$15\frac{1}{4}$
$1\frac{1}{8}$	2 15	$1\frac{3}{4}$	$10\frac{1}{4}$	$2\frac{3}{8}$	6 80	3	$15\frac{1}{4}$
1	2 30	$1\frac{7}{8}$	$10\frac{3}{4}$	$2\frac{7}{8}$	7 10	$3\frac{1}{8}$	$15\frac{1}{2}$
$1\frac{1}{8}$	2 45	$1\frac{7}{8}$	$10\frac{3}{4}$	$2\frac{1}{2}$	7 40	$3\frac{1}{8}$	$15\frac{1}{2}$
$1\frac{1}{8}$	2 60	2	$11\frac{1}{4}$	$2\frac{9}{16}$	7 70	$3\frac{1}{8}$	$15\frac{1}{2}$
$1\frac{3}{8}$	2 75	2	$11\frac{1}{4}$	$2\frac{3}{8}$	8 00	$3\frac{1}{4}$	$15\frac{3}{4}$
$1\frac{1}{4}$	2 90	$2\frac{1}{8}$	$11\frac{3}{4}$	$2\frac{11}{16}$	8 35	$3\frac{1}{4}$	$15\frac{3}{4}$
$1\frac{5}{8}$	3 05	$2\frac{1}{8}$	$11\frac{3}{4}$	$2\frac{1}{4}$	8 70	$3\frac{1}{4}$	$15\frac{3}{4}$
$1\frac{3}{4}$	3 20	$2\frac{1}{4}$	$12\frac{1}{4}$	$2\frac{3}{8}$	9 00	$3\frac{3}{8}$	16
$1\frac{7}{8}$	3 35	$2\frac{1}{4}$	$12\frac{1}{4}$	$2\frac{7}{8}$	9 35	$3\frac{3}{8}$	16
$1\frac{1}{2}$	3 50	$2\frac{3}{8}$	$12\frac{3}{4}$	$2\frac{5}{8}$	9 70	$3\frac{1}{2}$	$16\frac{1}{4}$
$1\frac{9}{16}$	3 65	$2\frac{3}{8}$	$12\frac{3}{4}$	3	10 00	$3\frac{1}{2}$	$16\frac{1}{4}$
$1\frac{5}{8}$	3 80	$2\frac{1}{2}$	$13\frac{1}{4}$				

All orders will be filled with exact size reamers unless otherwise specified.

Fluted Chucking Reamers

Process Patented June 9 and 23, 1903

With Morse Taper Shanks



These reamers can be furnished .004 to .010 inch under size, at regular prices.

Diam. Inches	Price Each	Total Length Inches	Length of Flute Inches	No. of Morse Taper Shank	Diam. Inches	Price Each	Total Length Inches	Length of Flute Inches	No. of Morse Taper Shank
$\frac{1}{4}$	\$1 20	5 $\frac{7}{8}$	$\frac{7}{8}$	No. 1	$1\frac{3}{4}$	\$5 30	13 $\frac{1}{2}$	2 $\frac{3}{8}$	No. 5
$\frac{5}{16}$	1 30	5 $\frac{7}{8}$	$\frac{7}{8}$		$1\frac{3}{8}$	5 50	13 $\frac{1}{2}$	2 $\frac{3}{8}$	
$\frac{3}{8}$	1 45	6 $\frac{7}{8}$	1		$1\frac{7}{8}$	5 70	14	2 $\frac{1}{2}$	
$\frac{7}{8}$	1 55	6 $\frac{7}{8}$	1		$1\frac{5}{8}$	5 95	14	2 $\frac{1}{2}$	
$\frac{1}{2}$	1 65	7 $\frac{7}{8}$	1 $\frac{1}{8}$		2	6 20	14	2 $\frac{1}{2}$	
$\frac{9}{16}$	1 75	7 $\frac{7}{8}$	1 $\frac{1}{8}$	No. 2	$2\frac{1}{16}$	6 50	14 $\frac{1}{2}$	2 $\frac{3}{4}$	
$\frac{5}{8}$	1 90	8 $\frac{7}{8}$	1 $\frac{1}{4}$		$2\frac{1}{8}$	6 80	14 $\frac{1}{2}$	2 $\frac{3}{4}$	
$\frac{11}{8}$	2 00	8 $\frac{7}{8}$	1 $\frac{1}{4}$		$2\frac{3}{8}$	7 10	14 $\frac{1}{2}$	2 $\frac{3}{4}$	
$\frac{3}{4}$	2 20	9 $\frac{3}{8}$	1 $\frac{3}{8}$		$2\frac{1}{4}$	7 40	14 $\frac{1}{2}$	2 $\frac{3}{4}$	
$\frac{13}{8}$	2 40	9 $\frac{3}{8}$	1 $\frac{3}{8}$		$2\frac{5}{8}$	7 70	15	3	
$\frac{7}{8}$	2 55	9 $\frac{7}{8}$	1 $\frac{1}{2}$	No. 3	$2\frac{3}{8}$	8 00	15	3	
$\frac{15}{8}$	2 65	9 $\frac{7}{8}$	1 $\frac{1}{2}$		$2\frac{7}{8}$	8 40	15	3	
1	2 75	10 $\frac{3}{8}$	1 $\frac{5}{8}$		$2\frac{1}{2}$	8 80	15	3	
$1\frac{1}{8}$	2 85	10 $\frac{3}{8}$	1 $\frac{5}{8}$		$2\frac{9}{8}$	9 20	15 $\frac{1}{2}$	3 $\frac{1}{4}$	
$1\frac{1}{4}$	3 10	10 $\frac{7}{8}$	1 $\frac{3}{4}$		$2\frac{5}{8}$	9 60	15 $\frac{1}{2}$	3 $\frac{1}{4}$	
$1\frac{3}{8}$	3 30	10 $\frac{7}{8}$	1 $\frac{3}{4}$	No. 4	$2\frac{11}{8}$	10 00	15 $\frac{1}{2}$	3 $\frac{1}{4}$	
$1\frac{1}{2}$	3 50	11 $\frac{1}{8}$	1 $\frac{7}{8}$		$2\frac{3}{4}$	10 40	15 $\frac{1}{2}$	3 $\frac{1}{4}$	
$1\frac{5}{8}$	3 70	11 $\frac{1}{8}$	1 $\frac{7}{8}$		$2\frac{5}{4}$	10 80	16	3 $\frac{1}{2}$	
$1\frac{3}{4}$	3 95	11 $\frac{1}{8}$	2		$2\frac{7}{8}$	11 20	16	3 $\frac{1}{2}$	
$1\frac{7}{8}$	4 15	11 $\frac{1}{8}$	2		$2\frac{15}{8}$	11 60	16	3 $\frac{1}{2}$	
$1\frac{1}{2}$	4 40	12 $\frac{1}{8}$	2 $\frac{1}{8}$	No. 5	3	12 00	16	3 $\frac{1}{2}$	
$1\frac{9}{8}$	4 60	12 $\frac{1}{8}$	2 $\frac{1}{8}$						
$1\frac{5}{8}$	4 85	12 $\frac{1}{8}$	2 $\frac{1}{4}$						
$1\frac{11}{8}$	5 10	12 $\frac{1}{8}$	2 $\frac{1}{4}$						

All orders will be filled with exact size reamers unless otherwise specified.

Rose Chucking Reamers

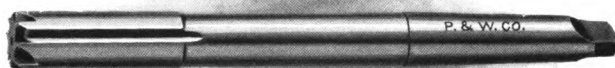
Straight Shank for Screw and Chucking Machine



Diameter Inches	Price Each	Total Length Inches	Length of Flute Inches	Diameter Inches	Price Each	Total Length Inches	Length of Flute Inches
$\frac{1}{4}$	\$0 80	6	$1\frac{1}{2}$	$1\frac{11}{16}$	\$3 75	13	$3\frac{3}{4}$
$\frac{5}{16}$	90	6	$1\frac{1}{2}$	$1\frac{3}{4}$	3 90	$13\frac{1}{2}$	4
$\frac{3}{8}$	1 00	7	$1\frac{3}{4}$	$1\frac{13}{16}$	4 05	$13\frac{1}{2}$	4
$\frac{7}{16}$	1 10	7	$1\frac{3}{4}$	$1\frac{7}{8}$	4 20	14	$4\frac{1}{4}$
$\frac{1}{2}$	1 20	8	2	$1\frac{1}{2}$	4 40	14	$4\frac{1}{4}$
$\frac{9}{16}$	1 30	8	2	2	4 60	14	$4\frac{1}{4}$
$\frac{5}{8}$	1 40	9	$2\frac{1}{4}$	$2\frac{1}{16}$	4 90	$14\frac{1}{2}$	$4\frac{1}{2}$
$\frac{11}{16}$	1 50	9	$2\frac{1}{4}$	$2\frac{1}{8}$	5 20	$14\frac{1}{2}$	$4\frac{1}{2}$
$\frac{3}{4}$	1 60	$9\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{3}{16}$	5 50	$14\frac{1}{2}$	$4\frac{1}{2}$
$\frac{13}{16}$	1 70	$9\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{4}$	5 80	$14\frac{1}{2}$	$4\frac{1}{2}$
$\frac{7}{8}$	1 80	10	$2\frac{5}{8}$	$2\frac{5}{16}$	6 10	15	$4\frac{3}{4}$
$1\frac{1}{8}$	1 95	10	$2\frac{5}{8}$	$2\frac{3}{8}$	6 40	15	$4\frac{3}{4}$
1	2 10	$10\frac{1}{2}$	$2\frac{3}{4}$	$2\frac{7}{16}$	6 80	15	$4\frac{3}{4}$
$1\frac{1}{16}$	2 25	$10\frac{1}{2}$	$2\frac{3}{4}$	$2\frac{1}{2}$	7 20	15	$4\frac{3}{4}$
$1\frac{1}{8}$	2 40	11	$2\frac{7}{8}$	$2\frac{9}{16}$	7 50	$15\frac{1}{2}$	5
$1\frac{3}{16}$	2 55	11	$2\frac{7}{8}$	$2\frac{5}{8}$	7 80	$15\frac{1}{2}$	5
$1\frac{1}{4}$	2 70	$11\frac{1}{2}$	3	$2\frac{11}{16}$	8 10	$15\frac{1}{2}$	5
$1\frac{5}{16}$	2 85	$11\frac{1}{2}$	3	$2\frac{3}{4}$	8 40	$15\frac{1}{2}$	5
$1\frac{3}{8}$	3 00	12	$3\frac{1}{4}$	$2\frac{13}{16}$	8 80	16	$5\frac{1}{4}$
$1\frac{7}{16}$	3 15	12	$3\frac{1}{4}$	$2\frac{7}{8}$	9 20	16	$5\frac{1}{4}$
$1\frac{1}{2}$	3 30	$12\frac{1}{2}$	$3\frac{1}{2}$	$2\frac{15}{16}$	9 60	16	$5\frac{1}{4}$
$1\frac{9}{16}$	3 45	$12\frac{1}{2}$	$3\frac{1}{2}$	3	10 00	16	$5\frac{1}{4}$
$1\frac{5}{8}$	3 60	13	$3\frac{3}{4}$				

Rose Chucking Reamers

With Morse Taper Shanks



Diam. Inches	Price Each	Total Length Inches	Length of Flute Inches	No. of Morse Taper Shank	Diam. Inches	Price Each	Total Length Inches	Length of Flute Inches	No. of Morse Taper Shank
$\frac{1}{4}$	\$1 20	$5\frac{7}{8}$	$1\frac{1}{2}$	No. 1	$1\frac{3}{4}$	\$5 30	$13\frac{1}{2}$	4	No. 5
$\frac{5}{16}$	1 30	$5\frac{7}{8}$	$1\frac{1}{2}$		$1\frac{13}{16}$	5 50	$13\frac{1}{2}$	4	
$\frac{3}{8}$	1 45	$6\frac{7}{8}$	$1\frac{3}{4}$		$1\frac{7}{8}$	5 70	14	$4\frac{1}{4}$	
$\frac{7}{16}$	1 55	$6\frac{7}{8}$	$1\frac{3}{4}$		$1\frac{15}{16}$	5 95	14	$4\frac{1}{4}$	
$\frac{1}{2}$	1 65	$7\frac{7}{8}$	2		2	6 20	14	$4\frac{1}{4}$	
$\frac{9}{16}$	1 75	$7\frac{7}{8}$	2	No. 2	$2\frac{1}{16}$	6 50	$14\frac{1}{2}$	$4\frac{1}{2}$	
$\frac{5}{8}$	1 90	$8\frac{7}{8}$	$2\frac{1}{4}$		$2\frac{1}{8}$	6 80	$14\frac{1}{2}$	$4\frac{1}{2}$	
$\frac{11}{16}$	2 00	$8\frac{7}{8}$	$2\frac{1}{4}$		$2\frac{3}{16}$	7 10	$14\frac{1}{2}$	$4\frac{1}{2}$	
$\frac{3}{4}$	2 20	$9\frac{3}{8}$	$2\frac{1}{2}$		$2\frac{1}{4}$	7 40	$14\frac{1}{2}$	$4\frac{1}{2}$	
$\frac{13}{16}$	2 40	$9\frac{3}{8}$	$2\frac{1}{2}$		$2\frac{5}{16}$	7 70	15	$4\frac{3}{4}$	
$\frac{7}{8}$	2 55	$9\frac{7}{8}$	$2\frac{3}{8}$	No. 3	$2\frac{3}{8}$	8 00	15	$4\frac{3}{4}$	
$\frac{15}{16}$	2 65	$9\frac{7}{8}$	$2\frac{3}{8}$		$2\frac{7}{16}$	8 40	15	$4\frac{3}{4}$	
1	2 75	$10\frac{3}{8}$	$2\frac{3}{4}$		$2\frac{1}{2}$	8 80	15	$4\frac{3}{4}$	
$1\frac{1}{16}$	2 85	$10\frac{3}{8}$	$2\frac{3}{4}$		$2\frac{9}{16}$	9 20	$15\frac{1}{2}$	5	
$1\frac{1}{8}$	3 10	$10\frac{7}{8}$	$2\frac{7}{8}$		$2\frac{5}{8}$	9 60	$15\frac{1}{2}$	5	
$1\frac{3}{16}$	3 30	$10\frac{7}{8}$	$2\frac{7}{8}$	No. 4	$2\frac{11}{16}$	10 00	$15\frac{1}{2}$	5	
$1\frac{1}{4}$	3 50	$11\frac{7}{16}$	3		$2\frac{3}{4}$	10 40	$15\frac{1}{2}$	5	
$1\frac{5}{16}$	3 70	$11\frac{7}{16}$	3		$2\frac{13}{16}$	10 80	16	$5\frac{1}{4}$	
$1\frac{3}{8}$	3 95	$11\frac{15}{16}$	$3\frac{1}{4}$		$2\frac{7}{8}$	11 20	16	$5\frac{1}{4}$	
$1\frac{7}{16}$	4 15	$11\frac{15}{16}$	$3\frac{1}{4}$		$2\frac{15}{16}$	11 60	16	$5\frac{1}{4}$	
$1\frac{1}{2}$	4 40	12	$3\frac{1}{2}$	No. 5	3	12 00	16	$5\frac{1}{4}$	
$1\frac{9}{16}$	4 60	12	$3\frac{1}{2}$						
$1\frac{5}{8}$	4 85	12	$3\frac{3}{4}$						
$1\frac{11}{16}$	5 10	12	$3\frac{3}{4}$						

Standard Taper Reamers

With Square Shanks

Process Patented June 9 and 23, 1903

For Locomotive Work



Taper $\frac{1}{16}$ inch per foot. Adopted generally by the railroad companies of the United States.

Taper $\frac{3}{32}$ inch per foot also furnished to order at regular prices.

Diameter at End Inches	Price Each	Length of Flute Inches	Total Length Inches	Diameter at End Inches	Price Each	Length of Flute Inches	Total Length Inches
$\frac{1}{4}$	\$2 20	4	5	$1\frac{1}{16}$	\$5 70	$10\frac{1}{2}$	$12\frac{3}{8}$
$\frac{5}{16}$	2 20	$4\frac{1}{4}$	$5\frac{1}{4}$	$1\frac{1}{8}$	6 20	12	$14\frac{3}{8}$
$\frac{3}{8}$	2 25	$4\frac{3}{4}$	$5\frac{3}{4}$	$1\frac{3}{16}$	6 60	12	$14\frac{3}{8}$
$\frac{7}{16}$	2 25	5	$6\frac{1}{8}$	$1\frac{1}{4}$	7 00	$13\frac{1}{2}$	16
$\frac{1}{2}$	2 30	$5\frac{1}{2}$	$6\frac{3}{4}$	$1\frac{5}{16}$	7 60	$13\frac{1}{2}$	16
$\frac{9}{16}$	2 40	$5\frac{3}{4}$	7	$1\frac{3}{8}$	8 00	14	$16\frac{1}{2}$
$\frac{5}{8}$	2 55	6	$7\frac{3}{8}$	$1\frac{7}{16}$	8 50	14	$16\frac{1}{2}$
$\frac{11}{16}$	2 70	$6\frac{1}{2}$	$7\frac{7}{8}$	$1\frac{1}{2}$	9 00	$14\frac{1}{2}$	17
$\frac{3}{4}$	3 00	7	$8\frac{3}{8}$	$1\frac{9}{16}$	9 60	$14\frac{1}{2}$	17
$\frac{7}{8}$	3 20	7	$8\frac{3}{8}$	$1\frac{5}{8}$	10 20	15	18
$\frac{15}{16}$	3 50	$7\frac{1}{2}$	$9\frac{1}{8}$	$1\frac{11}{16}$	10 85	15	18
1	3 80	$7\frac{1}{2}$	$9\frac{1}{8}$	$1\frac{3}{4}$	11 60	16	19
	4 10	$8\frac{1}{2}$	$10\frac{3}{8}$	$1\frac{7}{8}$	12 40	16	19
	4 50	$8\frac{1}{2}$	$10\frac{3}{8}$	$1\frac{9}{8}$	13 25	17	$20\frac{1}{4}$
	4 80	$9\frac{1}{2}$	$11\frac{1}{2}$	$1\frac{5}{8}$	14 25	$17\frac{1}{2}$	$20\frac{3}{4}$
	5 10	$9\frac{1}{2}$	$11\frac{1}{2}$	2	15 25	18	$21\frac{3}{4}$
	5 40	$10\frac{1}{2}$	$12\frac{5}{8}$				

Special reamers of this or different taper per foot, or different length of flute, made to order to specification or drawing, at prices corresponding proportionately to above list.

Blank order slips furnished on application.

Standard Taper Reamers

With Morse Taper Shanks

Process Patented June 9 and 23, 1903

For Locomotive Work



Taper $\frac{1}{16}$ inch per foot. Adopted generally by the railroad companies of the United States.

Taper $\frac{3}{32}$ inch per foot also furnished to order at regular prices.

Diam. at End Inches	Price Each	Length of Flute Inches	Total Length Inches	No. of Morse Taper Shank	Diam. at End Inches	Price Each	Length of Flute Inches	Total Length Inches	No. of Morse Taper Shank
$\frac{1}{4}$	\$3 10	4	$6\frac{7}{8}$	No. 1	$1\frac{1}{16}$	\$6 60	$10\frac{1}{2}$	$14\frac{13}{16}$	No. 3
$\frac{9}{32}$	3 10	$4\frac{1}{4}$	$7\frac{1}{8}$		$1\frac{1}{8}$	6 80	12	$16\frac{3}{8}$	
$\frac{3}{16}$	3 15	$4\frac{3}{4}$	$7\frac{3}{8}$		$1\frac{1}{8}$	7 25	12	$16\frac{3}{8}$	
$\frac{11}{32}$	3 15	5	$7\frac{15}{16}$		$1\frac{1}{4}$	7 70	$13\frac{1}{2}$	$18\frac{15}{16}$	
$\frac{3}{8}$	3 20	$5\frac{1}{2}$	$8\frac{7}{16}$		$1\frac{5}{16}$	8 35	$13\frac{1}{2}$	$18\frac{15}{16}$	
$\frac{13}{32}$	3 25	$5\frac{3}{4}$	$8\frac{11}{16}$		$1\frac{3}{8}$	8 80	14	$19\frac{7}{16}$	
$\frac{7}{16}$	3 30	6	$8\frac{15}{16}$		$1\frac{7}{16}$	9 35	14	$19\frac{7}{16}$	
$\frac{15}{32}$	3 45	$6\frac{1}{2}$	$9\frac{7}{16}$		$1\frac{1}{2}$	9 90	$14\frac{1}{2}$	$19\frac{15}{16}$	
$\frac{1}{2}$	3 50	7	$9\frac{15}{16}$		$1\frac{9}{16}$	10 55	$14\frac{1}{2}$	$19\frac{15}{16}$	
$\frac{9}{16}$	3 50	7	$9\frac{15}{16}$		$1\frac{5}{8}$	11 20	15	$20\frac{1}{2}$	
$\frac{5}{8}$	4 00	$7\frac{1}{2}$	11	No. 2	$1\frac{11}{16}$	11 95	15	$20\frac{1}{2}$	No. 4
$\frac{11}{16}$	4 50	$7\frac{1}{2}$	11		$1\frac{3}{4}$	12 75	16	$22\frac{3}{4}$	
$\frac{3}{4}$	4 90	$8\frac{1}{2}$	$12\frac{1}{8}$		$1\frac{13}{16}$	13 65	16	$22\frac{3}{4}$	
$\frac{13}{16}$	5 30	$8\frac{1}{2}$	$12\frac{1}{8}$		$1\frac{7}{8}$	14 60	17	$23\frac{3}{4}$	
$\frac{7}{8}$	5 70	$9\frac{1}{2}$	$13\frac{1}{8}$	No. 3	$1\frac{15}{16}$	15 70	$17\frac{1}{2}$	$24\frac{1}{4}$	No. 5
$\frac{15}{16}$	6 05	$9\frac{1}{2}$	$13\frac{13}{16}$		2	16 80	18	$25\frac{1}{8}$	
1	6 40	$10\frac{1}{2}$	$14\frac{13}{16}$						

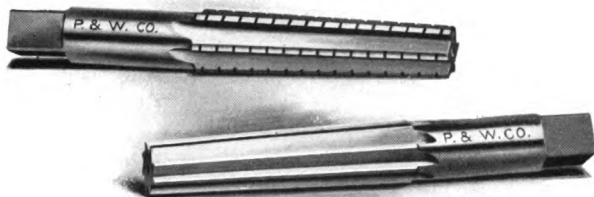
Special reamers of this or different taper per foot, or different length of flute, made to order to specification or drawing, at prices corresponding proportionately to above list.

Blank order slips furnished on application.

Taper Reamers

Process Patented June 9 and 23, 1903

Morse Standard Taper



Reamer for Morse drill socket, No. 0	\$1 60
Reamer for Morse drill socket, No. 1	2 00
Reamer for Morse drill socket, No. 2	2 60
Reamer for Morse drill socket, No. 3	3 40
Reamer for Morse drill socket, No. 4	4 20
Reamer for Morse drill socket, No. 5	6 60
Reamer for Morse drill socket, No. 6	12 00

Either roughing or finishing reamers furnished at above prices.

Dimensions of Pratt & Whitney Co. Reamers for Morse Standard Taper Socket

No.	Diameter Small End Inches	Diameter Large End Inches	Length of Flute Inches	Total Length Inches	Taper per Foot Inches
0	0.252	0.369	2¼	3¾	0.625
1	0.369	0.510	2½	4½	0.600
2	0.572	0.741	3⅜	5⅝	0.602
3	0.778	0.979	4	6⅝	0.602
4	1.020	1.280	5	8	0.623
5	1.475	1.790	6	9⅝	0.630
6	2.116	2.559	8½	12¼	0.626

Standard Taper-pin Reamers

Process Patented June 9 and 23, 1903

Taper $\frac{1}{4}$ inch per Foot



No.	Diameter at Small End, Inches	Price, Each	Length of Flute, Inches	Total Length Inches
0	0.135	\$1 00	$1\frac{7}{8}$	$2\frac{5}{8}$
1	0.146	1 00	$1\frac{5}{8}$	$2\frac{9}{16}$
2	0.162	1 25	$1\frac{7}{8}$	$2\frac{7}{8}$
3	0.183	1 50	$2\frac{1}{8}$	$3\frac{1}{4}$
4	0.208	1 75	$2\frac{9}{16}$	$3\frac{3}{8}$
5	0.242	2 00	3	$4\frac{3}{8}$
6	0.273	2 25	$3\frac{3}{4}$	$5\frac{1}{4}$
7	0.331	2 50	$4\frac{1}{2}$	$6\frac{1}{4}$
8	0.398	3 00	$5\frac{3}{16}$	$7\frac{3}{16}$
9	0.482	3 50	$6\frac{1}{8}$	$8\frac{3}{8}$
10	0.581	4 00	7	$9\frac{1}{2}$
11	0.706	4 75	$8\frac{1}{4}$	$11\frac{1}{4}$
12	0.842	5 50	10	$13\frac{1}{2}$
13	1.009	6 50	12	16
14	1.250	7 75	14	$18\frac{1}{4}$

Diameter is taken at extreme end.

These reamer sizes are so arranged that each "overlaps" about $\frac{1}{2}$ inch the size smaller; the taper being the same, the advantage thus secured is obvious. Special or larger sizes made to order. Pratt & Whitney Co. adjustable tap wrench No. 1 takes squares of reamers Nos. 0 to 5. No. 2 tap wrench takes Nos. 6 to 9.

For list of standard taper pins, see page 128.

Taper Reamers for Bridge Builders

With Square or Morse Taper Shanks

P. & W. CO.

Full Diameter Inches	Diameter at Point Inches	Price Each	Length of Flute Inches	Length of Tapered End Inches	Length Over All Inches
1/2	1/4	\$2 75	5 1/4	3	8 1/8
9/16	5/16	2 80	5 1/4	3	8 1/8
5/8	3/4	2 90	6 1/4	3	9 1/8
11/16	3/8	3 00	6 5/8	3	9 1/2
3/4	7/16	3 10	7 5/8	3	10 1/2
13/16	1/2	3 30	7 5/8	3	10 1/2
7/8	9/16	3 50	7 5/8	3	10 5/8
15/16	5/8	3 70	7 5/8	3	10 5/8
1	11/16	3 90	7 5/8	3	10 5/8
1 1/16	3/4	4 00	7 5/8	3	10 5/8
1 1/8	7/8	4 20	7 5/8	3	10 5/8
1 1/4	1	4 40	7 5/8	3	10 5/8
1 3/8	1 1/8	4 60	7 5/8	3	10 5/8
1 1/2	1 1/4		7 5/8	3	10 5/8

P. & W. CO.

Full Diameter Inches	Diameter at Point Inches	Price Each	Length of Flute Inches	No. of Taper Shank	Length Over All Inches
1/2	1/4	\$2 75	5 1/4	2	9
9/16	5/16	2 80	5 1/4	2	9
5/8	3/4	2 90	6 1/4	2	10
11/16	3/8	3 00	6 5/8	3	11
3/4	7/16	3 10	7 5/8	3	12
13/16	1/2	3 30	7 5/8	3	12
7/8	9/16	3 50	7 5/8	3	12
15/16	5/8	3 70	7 5/8	3	12
1	11/16	3 90	7 5/8	3	12
1 1/16	3/4	4 00	7 5/8	3	12
1 1/8	7/8	4 20	7 5/8	3	12
1 1/4	1	4 40	7 5/8	3	12
1 3/8	1 1/8	4 60	7 5/8	3	12
1 1/2	1 1/4		7 5/8	3	12

Bit-brace Reamers

Taper $\frac{3}{4}$ inch per Foot



Diameter at Point Inches	Price Each	Length of Flute Inches	Total Length Inches	Diameter at Point Inches	Price Each	Length of Flute Inches	Total Length Inches
$\frac{1}{4}$	\$0 45	$2\frac{1}{2}$	$4\frac{3}{4}$	$\frac{9}{16}$	\$0 80	3	$6\frac{1}{4}$
$\frac{5}{16}$	50	$2\frac{1}{2}$	5	$\frac{3}{8}$	90	3	$6\frac{3}{4}$
$\frac{3}{8}$	55	3	$5\frac{1}{4}$	$\frac{11}{16}$	1 05	3	$7\frac{1}{4}$
$\frac{7}{8}$	60	3	$5\frac{1}{2}$	$\frac{1}{4}$	1 20	3	$7\frac{1}{4}$
$\frac{1}{2}$	70	3	$5\frac{3}{4}$				

Shanks are $\frac{1}{4} \times \frac{7}{16} \times 1\frac{1}{4}$ inch

Arbors for Shell Reamers



No.	Price Each	Fitting Sizes Inches	Full Length Inches	No.	Price Each	Fitting Sizes Inches	Full Length Inches
1	\$1 20	$\frac{1}{4}$ to $\frac{5}{16}$	6	8	\$2 70	$1\frac{1}{8}$ to 2	12
2	1 40	$\frac{3}{8}$ to $\frac{7}{16}$	7	9	3 00	$2\frac{1}{8}$ to $2\frac{1}{2}$	13
3	1 60	$\frac{1}{2}$ to $\frac{9}{16}$	8	10	3 40	$2\frac{3}{8}$ to 3	14
4	1 80	$\frac{5}{8}$ to $1\frac{1}{16}$	$8\frac{3}{4}$	11	5 00	$3\frac{1}{8}$ to $3\frac{1}{2}$	15
5	2 00	$\frac{3}{4}$ to $1\frac{1}{8}$	$9\frac{1}{2}$	12	7 00	$3\frac{3}{8}$ to 4	16
6	2 20	1 to $1\frac{1}{4}$	10	13	9 00	$4\frac{1}{8}$ to $4\frac{1}{2}$	17
7	2 40	$1\frac{5}{16}$ to $1\frac{3}{8}$	11	14	12 00	$4\frac{3}{8}$ to 5	18

Three-groove Chucking Reamers

With Morse Taper or Straight Shanks



These reamers will be furnished in exact sizes or $\frac{1}{64}$ inch under size at regular prices.

Diam. Inches	Price Each	Total Length Inches	Length of Flute Inches	No. of Morse Taper Shank	Diam. Inches	Price Each	Total Length Inches	Length of Flute Inches	No. of Morse Taper Shank
$\frac{3}{8}$	\$1 70	$6\frac{7}{16}$	$3\frac{1}{8}$	No. 1	$1\frac{3}{4}$	\$8 40	$15\frac{1}{4}$	$8\frac{1}{4}$	No. 5
$1\frac{7}{16}$	1 80	$6\frac{7}{16}$	$3\frac{1}{8}$		$1\frac{11}{16}$	8 80	$15\frac{1}{4}$	$8\frac{1}{4}$	
$1\frac{1}{2}$	1 90	$7\frac{7}{16}$	$4\frac{1}{8}$		$1\frac{7}{8}$	9 20	$15\frac{1}{4}$	$8\frac{1}{4}$	
$1\frac{9}{16}$	2 00	$7\frac{7}{16}$	$4\frac{1}{8}$		$1\frac{1}{2}$	9 50	$15\frac{1}{4}$	$8\frac{1}{4}$	
$1\frac{5}{8}$	2 60	$11\frac{9}{16}$	$7\frac{3}{4}$		2	9 80	$15\frac{1}{4}$	$8\frac{1}{4}$	
$1\frac{11}{16}$	2 75	$11\frac{9}{16}$	$7\frac{3}{4}$	No. 2	$2\frac{1}{16}$	10 60	$15\frac{1}{4}$	$8\frac{1}{4}$	
$1\frac{3}{4}$	2 90	$11\frac{9}{16}$	$7\frac{3}{4}$		$2\frac{1}{8}$	11 20	$15\frac{1}{4}$	$8\frac{1}{4}$	
$1\frac{13}{16}$	3 05	$11\frac{9}{16}$	$7\frac{3}{4}$		$2\frac{1}{4}$	12 00	$15\frac{1}{4}$	$8\frac{1}{4}$	
$1\frac{7}{8}$	3 20	$11\frac{9}{16}$	$7\frac{3}{4}$		$2\frac{1}{2}$	12 80	$15\frac{1}{4}$	$8\frac{1}{4}$	
$1\frac{15}{16}$	3 40	$12\frac{1}{2}$	$7\frac{7}{8}$		$2\frac{5}{8}$	13 60	$15\frac{1}{4}$	$8\frac{1}{4}$	
1	3 60	$12\frac{1}{2}$	$7\frac{7}{8}$	No. 3	$2\frac{3}{4}$	14 40	$15\frac{3}{4}$	$8\frac{5}{8}$	
$1\frac{1}{16}$	3 80	$12\frac{1}{2}$	$7\frac{7}{8}$		$2\frac{7}{8}$	15 00	$15\frac{3}{4}$	$8\frac{5}{8}$	
$1\frac{1}{8}$	4 00	$12\frac{1}{2}$	$7\frac{7}{8}$		$2\frac{1}{2}$	15 60	$15\frac{3}{4}$	$8\frac{5}{8}$	
$1\frac{1}{4}$	4 50	$12\frac{1}{2}$	$7\frac{7}{8}$		$2\frac{9}{16}$	16 20	$15\frac{3}{4}$	$8\frac{5}{8}$	
$1\frac{1}{2}$	4 80	$13\frac{3}{4}$	$8\frac{1}{8}$		$2\frac{5}{8}$	16 80	$16\frac{1}{4}$	$9\frac{1}{8}$	
$1\frac{3}{4}$	5 20	$13\frac{3}{4}$	$8\frac{1}{8}$	No. 4	$2\frac{11}{16}$	17 90	$16\frac{1}{4}$	$9\frac{1}{8}$	
$1\frac{5}{8}$	5 60	$13\frac{3}{4}$	$8\frac{1}{8}$		$2\frac{3}{4}$	19 00	$16\frac{1}{4}$	$9\frac{1}{8}$	
$1\frac{7}{8}$	6 00	$13\frac{3}{4}$	$8\frac{1}{8}$		$2\frac{7}{8}$	20 00	$16\frac{3}{4}$	$9\frac{5}{8}$	
$1\frac{15}{16}$	6 40	$13\frac{3}{4}$	$8\frac{1}{8}$		$2\frac{1}{2}$	21 00	$16\frac{3}{4}$	$9\frac{5}{8}$	
$1\frac{1}{2}$	6 90	$13\frac{3}{4}$	$8\frac{1}{8}$		$2\frac{5}{8}$	23 00	$16\frac{3}{4}$	$9\frac{5}{8}$	
$1\frac{5}{8}$	7 40	$13\frac{3}{4}$	$8\frac{1}{8}$		3	25 00	$16\frac{3}{4}$	$9\frac{5}{8}$	
$1\frac{3}{4}$	7 90	$13\frac{3}{4}$	$8\frac{1}{8}$						

All orders will be filled with reamers $\frac{1}{64}$ inch under size, unless otherwise specified.

Center Reamers

With 60-degree Inclusive, Angle



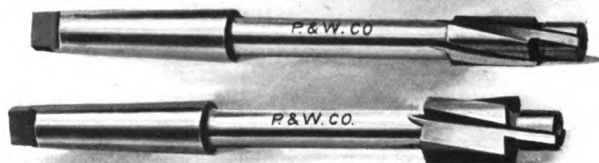
Prices

Size Shank Inches	Size Cut Inches	Weight Ounces	Old		New	
			Each	Dozen	Each	Dozen
$\frac{3}{16}$	$\frac{1}{4}$	$\frac{1}{4}$	\$0 22	\$2 50	\$0 25	\$2 90
$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	25	2 90	30	3 25
$\frac{3}{8}$	$\frac{1}{2}$	1	30	3 25	35	3 75
$\frac{1}{2}$	$\frac{3}{4}$	3	70	8 00	75	8 50

Special sizes made to order. Less than one-half dozen of a size will be charged at single price for each.

New-style reamers, having inclusive angles of 72 and 82 degrees, will be furnished at same price as those of 60 degrees.

Counterbores



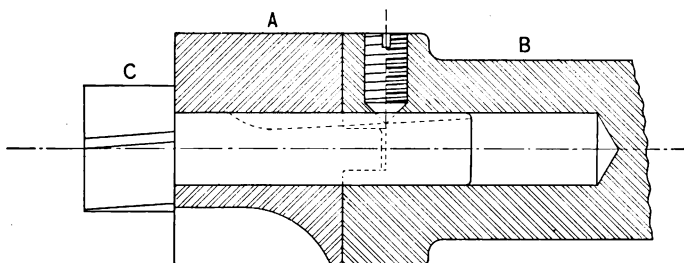
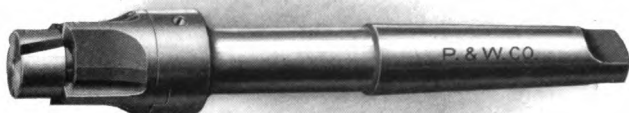
Are carried in stock of sizes given in the table below, with taper or straight shanks, and are furnished either singly or in sets consisting of one for body of screw and one for head, the guide point of each having the diameter of tap drill, and the counterbores having the diameters respectively of body and head of screws made to tables for U. S. Standard sizes.

The flute is spiral, similar to that of a twist drill, furnishing a good cutting edge, and a channel for chips. The counterbores are ground true after hardening.

Diameter of Screw and Pitch U. S. Standard	Diameter of Head Inches		Diameter of Guide Inches	Price Each	Length Over All Inches	Form Shank	
	P. & W. Standard	Hartford Machine Screw Co. Standard				Morse Standard Taper No.	Straight Round Diameter Inches
$\frac{3}{16}$, 32	$\frac{1}{4}$	$\frac{1}{4}$	.146	\$1 50	$4\frac{7}{8}$	1	$\frac{1}{4}$
$\frac{1}{4}$, 20	$\frac{11}{32}$	$\frac{3}{8}$	.184	1 50	$5\frac{1}{8}$	1	$\frac{1}{4}$
$\frac{5}{16}$, 18	$\frac{7}{16}$	$\frac{7}{16}$	.239	1 50	$5\frac{3}{8}$	1	$\frac{1}{2}$
$\frac{3}{8}$, 16	$\frac{1}{2}$	$\frac{9}{16}$	.293	1 50	$5\frac{1}{2}$	1	$\frac{1}{2}$
$\frac{7}{16}$, 14	$\frac{9}{16}$	$\frac{5}{8}$	.343	1 60	$6\frac{3}{8}$	2	$\frac{5}{8}$
$\frac{1}{2}$, 13	$\frac{11}{16}$	$\frac{3}{4}$	.398	1 60	$6\frac{1}{2}$	2	$\frac{5}{8}$
$\frac{9}{16}$, 12	$\frac{3}{4}$	$\frac{11}{16}$	.452	1 75	$7\frac{1}{4}$	2	$\frac{3}{4}$
$\frac{5}{8}$, 11	$\frac{7}{8}$	$\frac{7}{8}$	.505	2 00	$7\frac{3}{8}$	2	$\frac{3}{4}$
$\frac{11}{16}$, 11	$\frac{15}{16}$	$\frac{15}{16}$	.567	2 20	$10\frac{1}{8}$	3	$\frac{3}{4}$
$\frac{3}{4}$, 10	$1\frac{1}{16}$	1	.618	2 30	$10\frac{1}{2}$	3	$\frac{3}{4}$
$\frac{13}{16}$, 10	$1\frac{1}{8}$	$1\frac{1}{16}$	.681	2 50	$10\frac{7}{8}$	3	1
$\frac{7}{8}$, 9	$1\frac{3}{16}$	$1\frac{1}{8}$	.729	2 50	$11\frac{1}{4}$	3	1
$\frac{15}{16}$, 9	$1\frac{1}{4}$	$1\frac{3}{16}$	.791	2 50	12	3	1
1, 8	$1\frac{3}{8}$	$1\frac{1}{4}$	.836	2 80	12	3	1

Counterbores

With Interchangeable Cutters and Guides
Patent applied for



Prices and Sizes

Diameter of Cutter Inches	No. of Morse Taper Shank	Price Complete	Diameter of Cutter Inches	No. of Morse Taper Shank	Price Complete
$\frac{3}{4}$	1 or 2	\$7 35	$1\frac{1}{4}$	4	\$12 00
$\frac{7}{8}$	1 or 2	7 65	2	4	14 00
1	2 or 3	8 00	$2\frac{1}{4}$	4 or 5	15 35
$1\frac{1}{8}$	2 or 3	8 65	$2\frac{1}{2}$	5	16 65
$1\frac{1}{4}$	3 or 4	9 35	$2\frac{3}{4}$	5	18 50
$1\frac{1}{2}$	4	10 65	3	5	21 50

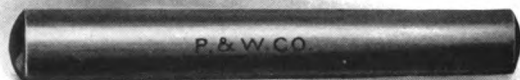
Intermediate sizes take list of next larger size listed.

Guides furnished in any diameter called for.

In ordering, specify No. of shank desired, diameter of cutter, and diameter of guide.

Miscellaneous Tools

Standard Steel Taper Pins



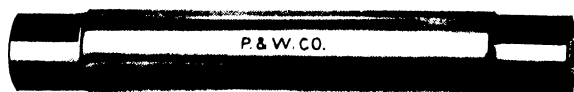
Taper one-quarter inch to the foot.
Sizes other than named below furnished to order at
special prices.

Price per 100

No.....	0	1	2	3	4	5	6	7	8	9	10
Diameter at Large End	.156	.172	.193	.219	.250	.289	.341	.409	.492	.591	.706
Approximate Fractional Sizes.....	$\frac{5}{32}$	$\frac{11}{64}$	$\frac{3}{16}$	$\frac{7}{32}$	$\frac{1}{4}$	$\frac{19}{64}$	$\frac{11}{32}$	$\frac{13}{32}$	$\frac{1}{2}$	$\frac{19}{32}$	$\frac{45}{64}$
Longest Limit of Length*	1	1 $\frac{1}{4}$	1 $\frac{1}{2}$	1 $\frac{3}{4}$	2	2 $\frac{1}{4}$	3 $\frac{1}{4}$	3 $\frac{3}{4}$	4 $\frac{1}{2}$	5 $\frac{1}{4}$	6
From $\frac{3}{4}$	1 80	2 00	2 10	2 30	2 50	2 75	3 00	....	....	....	....
1	2 05	2 25	2 35	2 55	2 75	3 00	3 25	3 75	....	....	....
1 $\frac{1}{4}$	2 50	2 60	2 80	3 00	3 25	3 50	4 00	4 65	....	....
1 $\frac{1}{2}$	2 85	3 05	3 25	3 50	3 75	4 25	5 00	7 00	9 00
1 $\frac{3}{4}$	3 30	3 50	3 75	4 00	4 50	5 40	7 50	9 50
2	3 75	4 05	4 35	4 75	5 80	8 00	10 00
2 $\frac{1}{4}$	4 40	4 75	5 25	6 25	8 60	10 75
2 $\frac{1}{2}$	5 20	5 75	6 75	9 20	11 50
2 $\frac{3}{4}$	5 70	6 25	7 25	9 80	12 25
3	6 25	6 75	7 80	10 50	13 25
3 $\frac{1}{4}$	6 75	7 25	8 40	11 20	14 25
3 $\frac{1}{2}$	7 75	9 00	11 90	15 25
3 $\frac{3}{4}$	8 25	9 60	12 60	16 25
4	10 20	13 30	17 25
4 $\frac{1}{4}$	10 80	14 00	18 25
4 $\frac{1}{2}$	11 40	14 70	19 25
4 $\frac{3}{4}$	15 40	20 25
5	16 10	21 25
5 $\frac{1}{4}$	16 80	22 25
5 $\frac{1}{2}$	23 25
5 $\frac{3}{4}$	24 25
6	25 25

*For length of flute of standard taper-pin reamer for each size, see page 119.

Hardened and Ground Steel Mandrels



Diameter Inches	Price Each	Length Inches	Diameter Inches	Price Each	Length Inches
$\frac{1}{4}$	\$0 65	$3\frac{3}{4}$	$2\frac{3}{16}$	\$6 00	12
$\frac{5}{16}$	75	4	$2\frac{1}{4}$	6 50	12
$\frac{3}{8}$	85	$4\frac{1}{4}$	$2\frac{5}{16}$	6 90	12
$\frac{7}{16}$	95	$4\frac{1}{2}$	$2\frac{3}{8}$	7 40	12
$\frac{1}{2}$	1 05	5	$2\frac{7}{16}$	7 90	$12\frac{1}{2}$
$\frac{9}{16}$	1 15	$5\frac{1}{4}$	$2\frac{1}{2}$	8 40	$12\frac{1}{2}$
$\frac{5}{8}$	1 25	$5\frac{1}{2}$	$2\frac{9}{16}$	8 90	$12\frac{1}{2}$
$\frac{11}{16}$	1 35	$5\frac{3}{4}$	$2\frac{3}{4}$	9 40	$12\frac{1}{2}$
$\frac{3}{4}$	1 45	6	$2\frac{11}{16}$	9 90	13
$\frac{7}{8}$	1 55	$6\frac{1}{4}$	$2\frac{3}{4}$	10 50	13
$\frac{15}{16}$	1 70	$6\frac{1}{2}$	$2\frac{13}{16}$	11 00	13
1	1 85	$6\frac{3}{4}$	$2\frac{7}{8}$	11 50	13
$1\frac{1}{16}$	2 00	7	$2\frac{15}{16}$	12 00	13
$1\frac{1}{8}$	2 10	$7\frac{1}{4}$	3	12 50	13
$1\frac{1}{4}$	2 20	$7\frac{1}{2}$	$3\frac{1}{16}$	13 00	14
$1\frac{3}{8}$	2 30	$7\frac{3}{4}$	$3\frac{1}{8}$	13 40	14
$1\frac{1}{2}$	2 45	8	$3\frac{3}{16}$	13 80	14
$1\frac{5}{8}$	2 60	$8\frac{1}{4}$	$3\frac{1}{2}$	14 10	14
$1\frac{3}{4}$	2 75	$8\frac{1}{2}$	$3\frac{5}{16}$	14 40	15
$1\frac{7}{8}$	2 90	$8\frac{3}{4}$	$3\frac{3}{8}$	14 70	15
$1\frac{9}{16}$	3 10	9	$3\frac{7}{16}$	15 00	15
$1\frac{11}{16}$	3 30	$9\frac{1}{4}$	$3\frac{1}{2}$	15 30	15
$1\frac{3}{4}$	3 50	$9\frac{1}{2}$	$3\frac{9}{16}$	15 60	16
$1\frac{15}{16}$	3 70	$9\frac{3}{4}$	$3\frac{5}{8}$	15 90	16
$1\frac{7}{8}$	3 90	10	$3\frac{11}{16}$	16 20	16
$1\frac{9}{8}$	4 10	$10\frac{1}{4}$	$3\frac{3}{4}$	16 50	16
$1\frac{11}{8}$	4 35	$10\frac{1}{2}$	$3\frac{13}{16}$	16 80	17
$1\frac{13}{8}$	4 60	$10\frac{3}{4}$	$3\frac{7}{8}$	17 20	17
2	4 80	11	$3\frac{15}{16}$	17 60	17
$2\frac{1}{16}$	5 15	$11\frac{1}{2}$	4	18 00	17
$2\frac{1}{8}$	5 60	$11\frac{1}{2}$			

Mandrels are made with a slight taper and correct diameters for *standard* holes.

The Renshaw Ratchet Drill

These tools are made in two sizes—No. 1 taking drills to $\frac{1}{2}$ inch, No. 3 taking drills to $1\frac{1}{2}$ inches. All the parts are made from steel and hardened.

No. 1 has one collet for drills, with shank $\frac{1}{8}\frac{1}{2}$ inch square at shoulder, and one collet for drills fitting No. 1 Morse's standard taper socket.

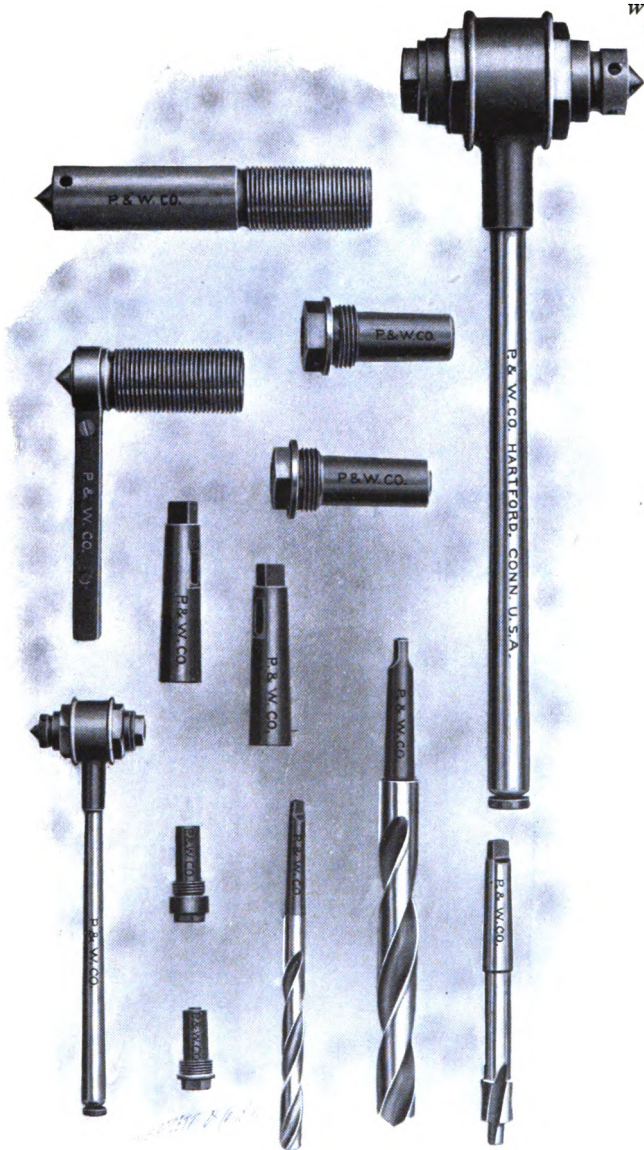
No. 3 has one collet, No. 5, for drills, with shank $\frac{1}{8}$ inch square at shoulder, of $\frac{1}{2}$ to $1\frac{1}{2}$ inches diameter, which are the extreme sizes that this ratchet is adapted to carry, and collets Nos. 1, 2 and 3, for Morse's standard taper shanks. No. 3 and No. 5 collets are held in the spindle by screw thread. No. 1 and No. 2 collets are tapered externally to fit No. 3 socket.

	No. 1	No. 3
Length of handle over all	9 $\frac{1}{2}$ in.	18 in.
Depth from top feed screw to bottom of collet	2 $\frac{1}{2}$ in.	5 in.
Full depth of feed	1 $\frac{1}{2}$ in.	2 $\frac{3}{4}$ in.

Price List

No. 1 ratchet drill complete, with two collets	\$11 00
No. 1 ratchet drill, with one collet	9 40
No. 1 collet, with square or taper hole, each	1 60
No. 3 ratchet drill complete, with four collets	15 00
No. 3 ratchet drill, with No. 3 or No. 5 collet only	11 05
No. 3 ratchet drill, with Nos. 1, 2 and 3 collets only	13 25
No. 1 or No. 2 collet for No. 3 ratchet, each	1 10
No. 3 or No. 5 collet for No. 3 ratchet, each	1 75
No. 1 ratchet body, each	2 20
No. 1 ratchet body nut, each	40
No. 1 feed screw, each	2 00
No. 1 feed pin, each	30
No. 1 ratchet handle, each	3 00
No. 1 pawl and spring, each	40
No. 3 ratchet body, each	3 00
No. 3 ratchet body nut, each	50
No. 3 feed screw, each	3 00
No. 3 extension feed screw, each	3 50
No. 3 feed pin, each	75
No. 3 ratchet handle, each	4 75
No. 3 pawl and spring, each	50
No. 3 friction feed attachment	3 00

We also carry in stock collets for No. 3 Renshaw ratchet for taper square-shank drills, $\frac{5}{8} \times \frac{3}{8} \times 1\frac{1}{2}$ inches long, also $\frac{3}{4} \times \frac{1}{2} \times 1\frac{3}{4}$ inches long, suitable for drills listed on page 136. Price, each, \$1.75.



The Renshaw Ratchet Drill

Twist Drills

With Morse Taper, or Straight Shanks



Diam. Inches	Price Each	Total Length Inches	Length of Fluted Portion Inches	No. of Morse Taper Shank	Diam. Inches	Price Each	Total Length Inches	Length of Fluted Portion Inches	No. of Morse Taper Shank
1/4	\$0 60	6 1/8	3	1	3/4	\$1 60	9 1/4	5 7/8	2
5/16	65	6 1/4	2 15/16		7/8	1 60	9 1/4	5 7/8	
3/8	70	6 3/4	2 15/16		1	1 70	9 1/2	5 11/16	
7/16	70	6 3/8	3 1/16		1 1/8	1 70	9 1/2	5 11/16	
1/2	75	6 1/2	3 1/16		1 1/4	1 85	9 3/4	5 15/16	
5/8	75	6 1/2	3 3/16		1 1/2	1 85	9 3/4	5 15/16	
3/4	80	6 3/4	3 1/8		1 3/4	2 00	9 7/8	6 1/16	
7/8	80	6 3/4	3 1/8		2	2 00	9 7/8	6 1/16	
1	85	7	3 1/8		2 1/8	2 15	10	6 3/16	
1 1/8	85	7	3 1/8		2 1/4	2 15	10	6 3/16	
1 1/4	90	7 1/4	3 1/2		2 3/8	2 30	10 1/4	6 7/16	
1 1/2	90	7 1/4	3 1/2		2 1/2	2 30	10 1/4	6 7/16	
1 3/4	95	7 1/2	4 3/8		2 3/4	2 45	10 1/2	6 11/16	
2	95	7 1/2	4 3/8		2 7/8	2 45	10 1/2	6 11/16	
2 1/4	1 00	7 3/4	4 7/8		3	2 60	10 5/8	6 13/16	
2 1/2	1 00	7 3/4	4 7/8		3 1/8	2 60	10 5/8	6 13/16	
2 3/4	1 10	8	4 7/8	2	3 1/4	2 75	10 3/4	6 1/4	3
3	1 10	8	4 7/8		3 3/8	2 75	10 3/4	6 1/4	
3 1/4	1 10	8	4 7/8		3 1/2	2 90	10 3/4	6 1/4	
3 1/2	1 20	8 1/4	4 11/16		3 3/4	2 90	10 3/4	6 1/4	
3 3/4	1 20	8 1/4	4 11/16		4	3 00	11	6 1/2	
4	1 30	8 1/2	5 3/16		4 1/8	3 00	11	6 1/2	
4 1/4	1 30	8 1/2	5 3/16		4 1/4	3 20	11 1/8	6 5/8	
4 1/2	1 40	8 3/4	5 1/2		4 3/8	3 20	11 1/8	6 5/8	
4 3/4	1 40	8 3/4	5 1/2		4 1/2	3 40	11 1/4	6 3/4	
5	1 50	9	5 3/8		4 3/4	3 40	11 1/4	6 3/4	
5 1/4	1 50	9	5 3/8		5	3 60	11 1/2	7	
5 1/2			5 1/2						
5 3/4									
6									
6 1/4									
6 1/2									
6 3/4									
7									

Twist Drills— *Continued*

Diam. Inches	Price Each	Total Length Inches	Length of Fluted Portion Inches	No. of Morse Taper Shank	Diam. Inches	Price Each	Total Length Inches	Length of Fluted Portion Inches	No. of Morse Taper Shank
1 ³ / ₂	\$3 60	11 ¹ / ₂	7	3	1 ³ / ₂	\$8 80	16 ¹ / ₄	10 ¹ / ₄	4
1 ⁵ / ₈	3 80	11 ³ / ₄	7 ¹ / ₄		1 ⁵ / ₈	9 00	16 ¹ / ₄	10 ¹ / ₄	
1 ¹ / ₂	3 80	11 ³ / ₄	7 ¹ / ₄		1 ¹ / ₂	9 00	16 ¹ / ₄	10 ¹ / ₄	
1 ⁹ / ₁₆	4 00	11 ⁷ / ₈	7 ³ / ₈		1 ⁹ / ₁₆	9 20	16 ¹ / ₂	10 ¹ / ₂	
1 ⁵ / ₁₆	4 00	11 ⁷ / ₈	7 ³ / ₈		1 ⁵ / ₁₆	9 20	16 ¹ / ₂	10 ¹ / ₂	
1 ³ / ₁₆	4 20	12	7 ¹ / ₂		1 ³ / ₁₆	9 35	16 ¹ / ₂	10 ¹ / ₂	
1 ¹ / ₁₆	4 20	12	7 ¹ / ₂		1 ¹ / ₁₆	9 35	16 ¹ / ₂	10 ¹ / ₂	
1 ¹ / ₈	4 40	12 ¹ / ₈	7 ⁵ / ₈		1 ¹ / ₈	9 50	16 ¹ / ₂	10 ¹ / ₂	
1 ¹ / ₈	4 40	12 ¹ / ₈	7 ⁵ / ₈		1 ¹ / ₈	9 50	16 ¹ / ₂	10 ³ / ₈	
1 ¹ / ₄	4 50	12 ¹ / ₂	8		1 ¹ / ₄	9 65	16 ¹ / ₂	10 ³ / ₈	
1 ¹ / ₄	4 50	12 ¹ / ₂	8		1 ¹ / ₄	9 65	16 ¹ / ₂	10 ³ / ₈	
1 ³ / ₈	4 65	14 ¹ / ₈	8 ⁵ / ₈		1 ³ / ₈	9 80	16 ¹ / ₂	10 ³ / ₈	
1 ³ / ₈	4 65	14 ¹ / ₈	8 ⁵ / ₈		2	9 80	16 ¹ / ₂	10 ³ / ₈	
1 ¹ / ₂	4 80	14 ¹ / ₄	8 ³ / ₄		2 ¹ / ₂	10 20	16 ¹ / ₂	9 ⁵ / ₈	
1 ⁵ / ₈	4 80	14 ¹ / ₄	8 ³ / ₄		2 ⁵ / ₈	10 60	17	10 ¹ / ₈	
1 ¹ / ₂	5 00	14 ³ / ₈	8 ⁷ / ₈		2 ¹ / ₂	10 90	17	10 ¹ / ₈	
1 ¹ / ₂	5 00	14 ³ / ₈	8 ⁷ / ₈		2 ³ / ₂	11 20	17	10 ¹ / ₈	
1 ¹ / ₂	5 20	14 ¹ / ₂	9		2 ⁵ / ₈	11 60	17	10 ¹ / ₈	
1 ³ / ₈	5 20	14 ¹ / ₂	9		2 ³ / ₈	12 00	17	10 ¹ / ₈	
1 ¹ / ₂	5 40	14 ⁵ / ₈	9 ¹ / ₈		2 ³ / ₈	12 40	17 ¹ / ₂	10 ⁵ / ₈	
1 ¹ / ₂	5 40	14 ⁵ / ₈	9 ¹ / ₈		2 ¹ / ₂	12 80	17 ¹ / ₂	10 ¹ / ₄	
1 ¹ / ₂	5 60	14 ³ / ₄	9 ¹ / ₄		2 ¹ / ₂	13 20	17 ¹ / ₂	10 ¹ / ₄	
1 ¹ / ₂	5 60	14 ³ / ₄	9 ¹ / ₄		2 ⁵ / ₈	13 60	17 ¹ / ₂	10 ¹ / ₄	
1 ¹ / ₂	5 80	14 ⁷ / ₈	9 ³ / ₈		2 ¹ / ₂	14 00	18	10 ³ / ₄	
1 ¹ / ₂	5 80	14 ⁷ / ₈	9 ³ / ₈		2 ³ / ₈	14 40	18	10 ⁵ / ₈	
1 ¹ / ₂	6 00	15	9 ¹ / ₂		2 ¹ / ₂	14 70	18 ¹ / ₂	11 ¹ / ₈	
1 ¹ / ₂	6 00	15	9 ¹ / ₂		2 ¹ / ₂	15 00	18 ¹ / ₂	11 ¹ / ₈	
1 ¹ / ₂	6 30	15	9 ¹ / ₂		2 ¹ / ₂	15 30	19	11 ³ / ₈	
1 ¹ / ₂	6 30	15	9 ¹ / ₂		2 ¹ / ₂	15 60	19	11 ¹ / ₂	
1 ¹ / ₂	6 60	15 ¹ / ₄	9 ³ / ₄		2 ¹ / ₂	15 90	19 ¹ / ₄	11 ³ / ₄	
1 ¹ / ₂	6 60	15 ¹ / ₄	9 ³ / ₄		2 ⁵ / ₈	16 20	19 ¹ / ₄	11 ³ / ₄	
1 ¹ / ₂	6 90	15 ¹ / ₄	9 ³ / ₄		2 ¹ / ₂	16 50	19 ¹ / ₂	12	
1 ¹ / ₂	6 90	15 ¹ / ₄	9 ³ / ₄		2 ⁵ / ₈	16 80	19 ¹ / ₂	11 ⁷ / ₈	
1 ¹ / ₂	7 20	15 ¹ / ₂	10	4	2 ³ / ₈	17 20	20	12 ³ / ₈	5
1 ¹ / ₂	7 20	15 ¹ / ₂	10		2 ¹ / ₂	17 60	20	12 ³ / ₈	
1 ¹ / ₂	7 50	15 ¹ / ₂	10		2 ³ / ₈	18 30	20 ¹ / ₂	12 ⁷ / ₈	
1 ¹ / ₂	7 50	15 ¹ / ₂	10		2 ³ / ₈	19 00	20 ¹ / ₂	12 ³ / ₄	
1 ¹ / ₂	7 80	15 ³ / ₄	10 ¹ / ₄		2 ³ / ₈	19 50	20 ¹ / ₂	12 ³ / ₄	
1 ¹ / ₂	7 80	15 ³ / ₄	10 ¹ / ₄		2 ¹ / ₂	20 00	20 ¹ / ₂	12 ³ / ₄	
1 ¹ / ₂	8 10	15 ³ / ₄	10 ¹ / ₄		2 ¹ / ₂	20 50	21	13 ¹ / ₄	
1 ¹ / ₂	8 10	15 ³ / ₄	9 ¹ / ₆		2 ⁷ / ₈	21 00	21	13 ¹ / ₈	
1 ¹ / ₂	8 40	16	10 ¹ / ₆		2 ⁷ / ₈	22 00	21	13 ¹ / ₈	
1 ¹ / ₂	8 40	16	10 ¹ / ₆		2 ¹ / ₂	23 00	21	13 ¹ / ₈	
1 ¹ / ₂	8 60	16	10 ¹ / ₆		2 ¹ / ₂	24 00	22	14 ¹ / ₈	
1 ¹ / ₂	8 60	16	10 ¹ / ₆		3	25 00	22	14	
1 ¹ / ₂	8 80	16 ¹ / ₄	10 ⁵ / ₈						

High-speed Drills

With Morse Taper, or Straight Shanks



Diam. Inches	Price Each	Total Length Inches	Length of Fluted Portion Inches	No. of Morse Taper Shank	Diam. Inches	Price Each	Total Length Inches	Length of Fluted Portion Inches	No. of Morse Taper Shank
1/4	\$1 10	6 1/8	3	No. 1	4 9	\$3 75	9 7/8	6 1/8	No. 2
1/4	1 20	6 1/4	2 1/2		4 9	3 75	9 7/8	6 1/8	
1/4	1 20	6 3/4	2 1/2		4 9	4 00	10	6 3/8	
1/4	1 30	6 3/8	3 1/8		4 9	4 00	10	6 3/8	
1/4	1 30	6 3/8	3 1/8		4 9	4 40	10 1/4	6 7/8	
1/4	1 40	6 1/2	3 3/8		4 9	4 40	10 1/4	6 7/8	
1/4	1 40	6 1/2	3 3/8		4 9	4 75	10 1/2	6 11/8	
1/4	1 50	6 3/4	3 7/8		4 9	4 75	10 1/2	6 11/8	
1/4	1 50	6 3/4	3 7/8		4 9	5 15	10 5/8	6 3/4	
1/4	1 65	7	3 11/8		4 9	5 15	10 5/8	6 3/4	
1/4	1 65	7	3 11/8		4 9	5 50	10 3/4	6 7/8	
1/4	1 75	7 1/4	3 15/8		4 9	5 50	10 3/4	6 7/8	
1/4	1 75	7 1/4	3 15/8		4 9	5 90	10 7/8	6 3/8	
1/4	1 90	7 1/2	4 3/8		4 9	5 90	10 7/8	6 3/8	
1/4	1 90	7 1/2	4 3/8		4 9	6 25	11	6 1/2	
1/2	2 00	7 3/4	4 7/8	No. 2	1 1/4	6 25	11	6 1/2	No. 3
1/2	2 00	7 3/4	4 7/8		1 1/4	6 75	11 1/8	6 5/8	
1/2	2 15	8	4 11/8		1 1/4	6 75	11 1/8	6 5/8	
1/2	2 15	8	4 11/8		1 1/4	7 25	11 1/4	6 3/4	
1/2	2 25	8 1/4	4 15/8		1 1/4	7 25	11 1/4	6 3/4	
1/2	2 25	8 1/4	4 15/8		1 1/4	7 75	11 1/2	7	
1/2	2 40	8 1/2	5 3/8		1 1/4	7 75	11 1/2	7	
1/2	2 40	8 1/2	5 3/8		1 1/4	8 25	11 3/4	7 1/4	
1/2	2 50	8 3/4	4 15/8		1 1/4	8 25	11 3/4	7 1/4	
1/2	2 50	8 3/4	4 15/8		1 1/4	8 90	11 7/8	7 3/8	
1/2	2 75	9	5 3/8		1 1/4	8 90	11 7/8	7 3/8	
1/2	2 75	9	5 3/8		1 1/4	9 50	12	7 1/2	
1/2	3 00	9 1/4	5 7/8		1 1/4	9 50	12	7 1/2	
1/2	3 00	9 1/4	5 7/8		1 1/4	10 15	12 1/8	7 3/8	
1/2	3 25	9 1/2	5 11/8		1 1/4	10 15	12 1/8	7 3/8	
1/2	3 25	9 1/2	5 11/8		1 1/4	10 75	12 1/2	8	
1/2	3 50	9 3/4	5 15/8		1 1/4	10 75	12 1/2	8	
1/2	3 50	9 3/4	5 15/8		1 1/4				

High-speed Drills—Continued

Diam. Inches	Price Each	Total Length Inches	Length of Fluted Portion Inches	No. of Morse Taper Shank	Diam. Inches	Price Each	Total Length Inches	Length of Fluted Portion Inches	No. of Morse Taper Shank
1 1/16	\$11 50	14 1/8	8 5/8	No. 4	1 1/8	\$26 25	16	10 1/8	No. 4
1 1/8	11 50	14 1/8	8 5/8		1 1/8	27 50	16 1/4	10 3/8	
1 1/4	12 25	14 1/4	8 3/4		1 1/8	27 50	16 1/4	10 1/4	
1 1/4	12 25	14 1/4	8 3/4		1 1/8	28 75	16 1/4	10 1/4	
1 1/2	13 00	14 3/8	8 7/8		1 1/8	28 75	16 1/4	10 1/4	
1 1/2	13 00	14 3/8	8 7/8		1 1/8	30 00	16 1/2	10 1/2	
1 3/8	13 75	14 1/2	9		1 1/8	30 00	16 1/2	10 1/2	
1 3/8	13 75	14 1/2	9		1 1/8	31 25	16 1/2	10 1/2	
1 3/4	14 65	14 3/8	9 1/8		1 1/8	31 25	16 1/2	10 1/2	
1 3/4	14 65	14 3/8	9 1/8		1 1/8	32 50	16 1/2	10 1/2	
1 7/8	15 50	14 3/4	9 1/4		1 1/8	32 50	16 1/2	10 3/8	
1 7/8	16 40	14 7/8	9 3/8		1 1/8	33 75	16 1/2	10 3/8	
1 7/8	16 40	14 7/8	9 3/8		1 1/8	33 75	16 1/2	10 3/8	
1 7/8	16 40	14 7/8	9 3/8		1 1/8	35 00	16 1/2	10 3/8	
1 7/8	17 25	15	9 1/2		2	35 00	16 1/2	10 3/8	
1 7/8	17 25	15	9 1/2		2 1/8	36 25	16 1/2	9 5/8	
1 7/8	18 15	15	9 1/2		2 1/8	37 50	17	10 3/8	
1 7/8	18 15	15	9 1/2		2 1/8	40 00	17	10 1/8	
1 7/8	19 00	15 1/4	9 3/4		2 1/8	42 50	17	10 3/8	
1 7/8	19 00	15 1/4	9 3/4		2 1/8	45 00	17 1/2	10 1/4	
1 7/8	20 00	15 1/4	9 3/4		2 1/8	50 00	17 1/2	10 1/4	
1 7/8	20 00	15 1/4	9 3/4		2 3/8	55 00	18	10 3/8	No. 5
1 7/8	21 00	15 1/2	10		2 1/8	60 00	18 1/2	11 1/8	
1 7/8	21 00	15 1/2	10		2 1/2	65 00	19	11 1/2	
1 7/8	22 00	15 1/2	10		2 1/8	70 00	19 1/4	11 3/4	
1 7/8	22 00	15 1/2	10		2 3/8	75 00	19 1/2	11 7/8	
1 7/8	23 00	15 3/4	10 1/4		2 1/8	80 00	20	12 3/8	
1 7/8	23 00	15 3/4	10 1/4		2 3/4	85 00	20 1/2	12 3/4	
1 7/8	24 00	15 3/4	10 1/4		2 1/8	90 00	20 1/2	12 3/4	
1 7/8	24 00	15 3/4	9 1/2		2 3/8	95 00	21	13 1/8	
1 7/8	25 00	16	10 1/8		2 1/8	100 00	21	13 1/8	
1 3/4	25 00	16	10 1/8		3	105 00	22	14	
1 3/4	26 25	16	10 1/8						

Drills with greater length of twist and special sizes, not listed above, made to order; prices on application.

If a drill is desired with a shank larger than listed for that size, the price will be the same as for the smallest size drill listed with required size of shank.

Taper Square-shank Drills

Fitting Renshaw Ratchets



Price, with shanks $\frac{5}{8}$ inch by $\frac{3}{8}$ inch and $1\frac{1}{2}$ inches long, and shanks $\frac{3}{4}$ inch by $\frac{1}{2}$ inch and $1\frac{3}{4}$ inches long.

Diameter Inches	Price Each	Length Inches	Diameter Inches	Price Each	Length Inches	Diameter Inches	Price Each	Length Inches
$\frac{1}{4}$	\$1 00	5	$\frac{5}{8}$	\$1 40	$6\frac{1}{2}$	$\frac{3}{16}$	\$2 40	$8\frac{1}{4}$
$\frac{9}{32}$	1 05	5	$\frac{21}{32}$	1 45	$6\frac{1}{2}$	$1\frac{1}{32}$	2 55	$8\frac{1}{2}$
$\frac{5}{16}$	1 10	5	$\frac{11}{16}$	1 45	$6\frac{1}{2}$	$1\frac{1}{8}$	2 70	$8\frac{3}{4}$
$\frac{11}{16}$	1 15	5	$\frac{23}{32}$	1 50	$6\frac{1}{2}$	$1\frac{1}{16}$	2 85	9
$\frac{3}{8}$	1 20	6	$\frac{3}{4}$	1 55	$6\frac{1}{2}$	$1\frac{1}{8}$	3 10	9
$\frac{13}{32}$	1 25	$6\frac{1}{4}$	$\frac{25}{32}$	1 65	$6\frac{3}{4}$	$1\frac{3}{16}$	3 35	9
$\frac{7}{16}$	1 25	$6\frac{1}{4}$	$\frac{13}{16}$	1 75	7	$1\frac{1}{4}$	3 65	9
$\frac{15}{32}$	1 30	$6\frac{1}{4}$	$\frac{27}{32}$	1 90	$7\frac{1}{4}$	$1\frac{5}{16}$	3 90	9
$\frac{1}{2}$	1 30	$6\frac{1}{2}$	$\frac{7}{8}$	2 05	$7\frac{1}{2}$	$1\frac{3}{8}$	4 20	9
$\frac{17}{32}$	1 35	$6\frac{1}{2}$	$\frac{29}{32}$	2 20	$7\frac{3}{4}$	$1\frac{7}{16}$	4 50	9
$\frac{9}{16}$	1 35	$6\frac{1}{2}$	$\frac{15}{16}$	2 30	8	$1\frac{1}{2}$	4 80	9
$\frac{19}{32}$	1 40	$6\frac{1}{2}$						

Collets for No. 3 Renshaw ratchet drill fitting above drills are carried in stock. See list on page 130.

Flat Drills

Fitting Renshaw Ratchets



Size, inches	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{3}{8}$	$1\frac{1}{2}$
Price, cents	40	40	40	45	45	45	50	55	60	65

Straight Shank Drills

Jobbers' and Machinists' Sets

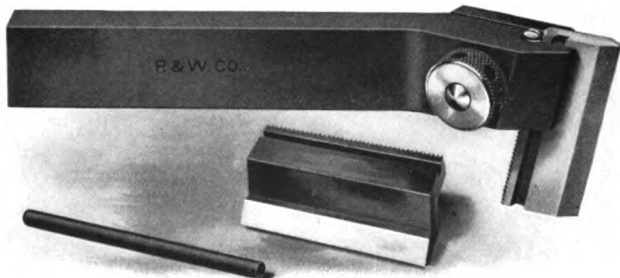
Diameter Inches	Price per Dozen	Price Each	Length Inches	Diameter Inches	Price per Dozen	Price Each	Length Inches
$\frac{1}{32}$	\$0 90	\$0 09	$1\frac{1}{16}$	$\frac{9}{32}$	\$3 65	\$0 32	$4\frac{1}{4}$
$\frac{3}{64}$	1 00	09	$1\frac{1}{8}$	$\frac{1}{4}$	3 90	35	$4\frac{3}{8}$
$\frac{1}{8}$	1 00	09	$2\frac{1}{2}$	$\frac{5}{16}$	4 20	37	$4\frac{1}{2}$
$\frac{5}{64}$	1 10	10	$2\frac{3}{8}$	$\frac{3}{8}$	4 50	40	$4\frac{5}{8}$
$\frac{3}{16}$	1 20	11	$2\frac{3}{4}$	$\frac{1}{2}$	4 80	42	$4\frac{3}{4}$
$\frac{7}{16}$	1 30	12	$2\frac{7}{8}$	$\frac{3}{4}$	5 10	45	$4\frac{7}{8}$
$\frac{1}{2}$	1 45	13	3	$\frac{7}{8}$	5 40	48	5
$\frac{9}{16}$	1 60	15	$3\frac{1}{8}$	$\frac{15}{16}$	5 70	50	$5\frac{1}{8}$
$\frac{5}{8}$	1 80	16	$3\frac{1}{4}$		6 00	53	$5\frac{1}{4}$
$\frac{3}{4}$	2 00	18	$3\frac{3}{8}$		6 40	55	$5\frac{3}{8}$
$\frac{11}{16}$	2 20	20	$3\frac{1}{2}$		6 80	59	$5\frac{1}{2}$
$\frac{13}{16}$	2 40	21	$3\frac{5}{8}$		7 20	63	$5\frac{5}{8}$
$\frac{7}{8}$	2 65	23	$3\frac{3}{4}$		7 50	65	$5\frac{3}{4}$
$\frac{15}{16}$	2 90	26	$3\frac{7}{8}$		7 75	67	$5\frac{7}{8}$
$\frac{1}{4}$	3 15	28	4	$\frac{1}{2}$	8 00	70	6
$\frac{1}{2}$	3 40	30	$4\frac{1}{8}$				

Straight Shank Wire Drills

Nos. by Gauge	Price per Dozen	Price, Each	Approximate Length, Inches
1 to 5	\$2 35	\$0 22	4
6 to 10	2 25	21	$3\frac{1}{16}$
11 to 15	2 10	20	$3\frac{1}{2}$
16 to 20	1 95	19	$3\frac{1}{4}$
21 to 25	1 75	17	$3\frac{1}{8}$
26 to 30	1 55	15	$2\frac{1}{16}$
31 to 35	1 40	14	$2\frac{1}{8}$
36 to 40	1 25	12	$2\frac{1}{4}$
41 to 45	1 10	10	$2\frac{1}{8}$
46 to 60	95	09	$2\frac{1}{16}$ to $1\frac{3}{4}$
61 to 70	90	08	$1\frac{1}{2}$
71 to 80	1 00	09	$1\frac{5}{16}$ to $\frac{3}{4}$

The P. & W. Threading Tool

With U. S. S., Whitworth Standard, or Sharp "V" Cutters



Combines economy with all essential points in a thread-cutting and forming tool. Cutters have 15 degrees clearance from perpendicular, which is ample for nearly all threads required, and the amount that experience has taught will wear the best on various metals. The same single-point cutter is used for right- and left-hand. Threads can be cut very close to a shoulder. Simply grind top of cutter to sharpen.

Forming tools and special thread tools made to sample, drawings or templets at special prices. All cutters will fit either Nos. 1, 2 or 3 holder.

Price List

No. 1 holder, with one U. S. or "V" cutter, $\frac{3}{4} \times \frac{3}{8} \times 5\frac{1}{4}$ inches, 10½ ounces	\$2 75
No. 2 holder, with one U. S. or "V" cutter, $1 \times \frac{1}{2} \times 6$ inches, 19 ounces	2 75
No. 3 holder, with one U. S. or "V" cutter, $1\frac{1}{2} \times \frac{5}{8} \times 8\frac{1}{2}$ inches, 2 pounds 14 ounces	5 00
Cutters, single-point, U. S. or "V," 4 to 20 pitch, $1\frac{1}{8} \times \frac{1}{4} \times 2\frac{1}{8}$ inches, 1¾ ounces	50
Cutters, single-point, U. S. or "V," 3, 3¼, 3½ pitch, $1 \times 1\frac{7}{8} \times 2\frac{1}{8}$ inches, 3 ounces	1 00
Cutters, single-point, Whitworth, 4½ to 20 pitch, each	1 00
Cutters, chasers, U. S. or "V," 4, 4½, 5, 5½, 4½ ounces	1 20
Cutters, chasers, U. S. or "V" (4 ounces), 7, 8 (2 ounces) ...	1 00
Cutters, chasers, U. S. or "V," 9, 10, 11, 11½, 12, 13, 2 ounces	90
Cutters, chasers, U. S. or "V," 14, 16, 18, 20, 1¾ ounces	90
Cutters, chasers, Whitworth, 4½, 5, 6, 7, 8, each	1 75
Cutters, chasers, Whitworth, 9, 10, 11, 12, each	1 50
Cutters, chasers, Whitworth, 14, 16, 18, 20, each	1 35
Center turning tool, 2¾ ounces	90
Single offset cutter, U. S. or "V," 1¾ ounces	50
Double offset cutter, U. S. or "V," 3 ounces	1 00
Strap bolt, 1¾ ounces, each	50
Strap adjusting screw, ¼ ounce, each	12
Upright adjusting screw, ¼ ounce, each	08
Nut, ¾ ounce, each	15
Clamp pin, ½ ounce, each	03

Chasers for P. & W. Threading Tool

Chasers and single-point cutters, U. S., "V" or Whitworth, of finer pitches than No. 20, are furnished at special prices.

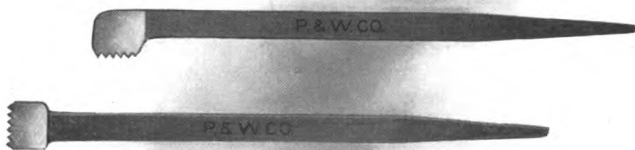
The cut above shows a chaser chamfered to the left for right-hand threading. U. S. Standard chasers are made sharp at bottom of thread but flatted on the top to correspond with the pitch to be cut.

In ordering cutters, be particular to name the holder, or state on which side the slot is, as the top of the cutter is looked upon from the rear. The No. 2 holder, made straight, is carried in stock.

For prices, see opposite page.

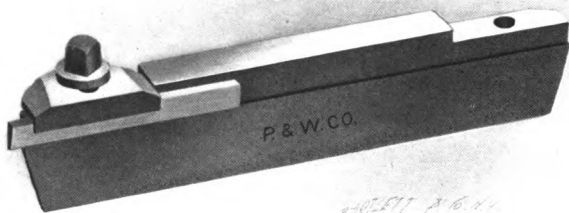


Inside and Outside Hand Chasers



Chasers for cutting "V" or U. S. Standard pitches, 3 to 8, each	\$0 50
Chasers for cutting "V" or U. S. Standard pitches, 9 to 20, each	35

Rhodes' Square Threading Tool



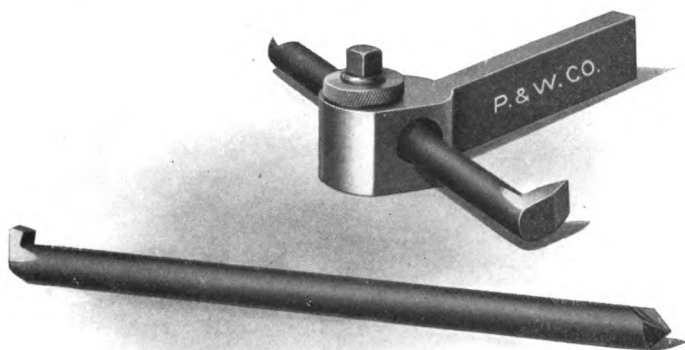
The above cut represents a convenient and economical holder and tool for cutting square threads. Right-hand threads are cut with one end of holder forward. By simply reversing holder and cutter, left-hand threads may be cut. The strap which clamps the cutter has an elongated hole, and adjusts itself to different widths of cutter, pressing the cutter against straight side of holder, and holding it rigidly in place. The cutters have clearance on the side. When nice work is desired, a cutter one size smaller than that required for finishing can be used for roughing out. Should a cutter require sharpening before the thread is finished, it can be taken out and ground without disturbing the holder; then, when replaced, it will be exactly right to resume its cut, which is a great advantage. Dimensions of holder, $\frac{1}{2} \times 1\frac{1}{8} \times 5\frac{5}{8}$ inches.

Holder, with one cutter, for any number of threads per inch in list; weight, 14 ounces.....	\$3 50
Single cutters, for any of the following threads, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14, 16.....	40
Holder and set of eleven cutters, in box, 25 $\frac{1}{4}$ ounces.....	7 50
Strap, weight, $\frac{1}{2}$ ounce.....	50
Screw (of steel), weight, $\frac{3}{8}$ ounce.....	10

Cutters of special pitches are furnished at special prices. That proper clearance may be had, cutters are regularly made $\frac{1}{16}$ inch wider than they should be to cut the groove the exact width of the land for any given pitch.

An order for cutters should state whether they are for cutting taps or screws.

Boring and Inside Threading Tool



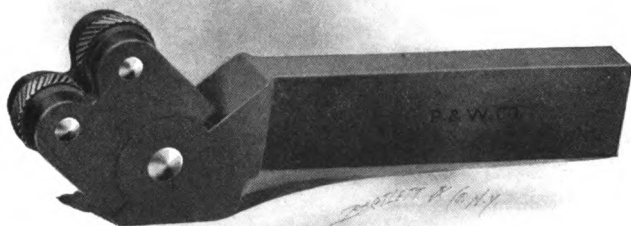
Cutter-bars for inside threading are furnished for either U. S. Standard or sharp "V" threads, and may be ground many times without changing their shape. Size of shank, $\frac{1}{2} \times 1$ inches. Parts interchangeable. The holder is made of steel. The screws are thoroughly hardened. The largest cutter is made with a drill point, to be used as a *starter*; a twist drill may then be inserted in the holder, a hole drilled and finished to size with one of the cutter-bars, and, if required, threaded, without removing the holder from the tool-post.

Price List

Holder, with three cutters for boring; weight, 53 ounces...	\$3 00
Cutter No. 1, $\frac{1}{8}$ -inch diameter, 8 inches long, for boring; weight, $3\frac{1}{2}$ ounces.....	20
For inside threading; weight, $3\frac{1}{2}$ ounces.....	50
Cutter No. 2, bars $\frac{1}{2}$ -inch diameter, 9 inches long, for boring; weight, $9\frac{1}{2}$ ounces.....	30
For inside threading; weight, $9\frac{1}{2}$ ounces.....	60
Cutter No. 3, bars $\frac{3}{8}$ -inch diameter, 10 inches long, for boring; weight, $15\frac{1}{2}$ ounces.....	50
For inside threading; weight, $15\frac{1}{2}$ ounces.....	80

Parties ordering inside threading tools should state pitch of thread and diameter of holes in which they are to be used.

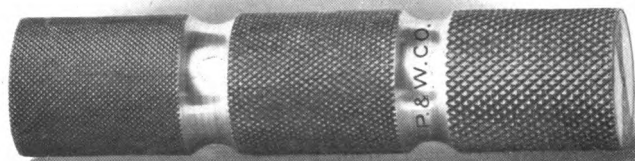
Knurling Tool



Any desired length and diameter can be knurled after the manner of turning in an engine lathe with continuous feed. The holder is jointed, that the knurls may center themselves, and be used in a weighted lathe without an extra weight being applied to the carriage to hold it in position. Knurls of three pitches are carried in stock.

Price of holder only, 1 x ½ x 6 inches; weight, 16 ounces..	\$4 00
Price of holder with one pair of knurls; weight, 17 ounces..	4 50
Extra knurls, per pair; weight, 1 ounce.....	75

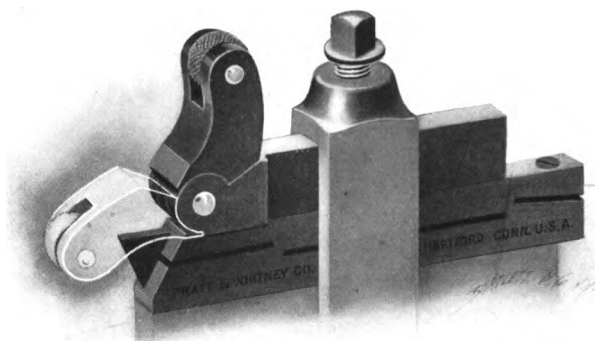
All knurls used in same holder.



The above cut shows form of fine, medium and coarse knurling.

The pitch of the knurled cut, measured parallel to axis of the work, is about 20 to the inch for fine knurls, 12 for medium, and 8 for coarse.

Knurling Tool for Screw Machine



The above cut shows a Johnson cut-off tool in use in connection with our screw-machine knurling tool.

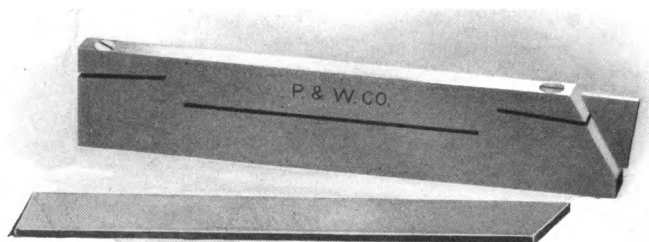
The knurling tool is made in three sizes, Nos. 1, 2 and 3.

- No. 1 has shank $2\frac{1}{2} \times \frac{17}{32} \times \frac{9}{32}$ inches.
- No. 2 has shank $3\frac{7}{16} \times \frac{3}{4} \times \frac{11}{32}$ inches.
- No. 3 has shank $3\frac{7}{16} \times \frac{7}{8} \times \frac{1}{2}$ inches.

Price, with one knurl for either size.....	\$4 50
Price of extra knurls, fine, medium or coarse, each.....	75

Johnson's Patent Cutting-off Tool

For Lathe, Planer and Screw Machine Use



Dimensions and Price List of Holders (with one blade)

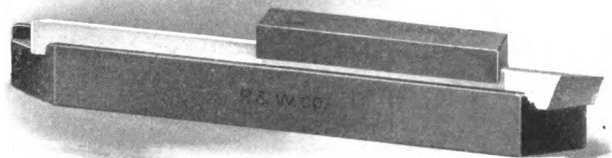
No.	Height Inches	Thickness Inches	Length Inches	Price Each
00	$\frac{3}{4}$	$\frac{5}{16}$	4	\$2 50
0	1	$\frac{1}{8}$	5	2 50
1	$1\frac{3}{16}$	$\frac{1}{2}$	$6\frac{3}{16}$	2 50
2	$1\frac{3}{8}$	$\frac{3}{8}$	$6\frac{3}{8}$	2 50
3	$1\frac{3}{4}$	$\frac{9}{16}$	$6\frac{1}{2}$	3 00
4	$1\frac{1}{2}$	$\frac{5}{8}$	$6\frac{1}{2}$	3 25

List of Blades, Johnson Cut-off Tool

No.	Thickness Inches	Width Inches	Price, Each Carbon Steel	Price, Each High Speed Steel
00	$\frac{1}{32}, \frac{3}{64}, \frac{1}{16}, \frac{5}{64}$	$\frac{1}{2}$	\$0 40	....
0	$\frac{1}{16}, \frac{3}{32}, \frac{1}{8}$	$\frac{1}{16}$	40	\$1 40
1 and 2	$\frac{1}{16}, \frac{3}{32}, \frac{1}{8}$	$\frac{3}{16}$	30	1 05
	$\frac{5}{32}, \frac{3}{16}, \frac{7}{32}, \frac{1}{4}$		35	1 25
	$\frac{3}{16}, \frac{7}{32}, \frac{1}{4}$		40	1 40
	$\frac{3}{16}, \frac{7}{32}, \frac{1}{4}$		45	1 60
	$\frac{3}{16}, \frac{7}{32}, \frac{1}{4}$		50	1 75
3 and 4	$\frac{3}{16}, \frac{7}{32}, \frac{1}{4}$	1	40	1 40
	$\frac{3}{16}, \frac{7}{32}, \frac{1}{4}$		45	1 60
	$\frac{3}{16}, \frac{7}{32}, \frac{1}{4}$		50	1 75
	$\frac{3}{16}, \frac{7}{32}, \frac{1}{4}$		55	1 95
	$\frac{3}{16}, \frac{7}{32}, \frac{1}{4}$		65	2 30

In ordering blades, give number or width of holder for which same are wanted.

Woodbridge Lathe and Planer Tool



The tool consists of holder, cap and four cutters.

Prices, Complete

No.	Dimensions Inches	Weight	Price	Extra Cutters Each
00	$\frac{5}{8}$ x $\frac{5}{16}$ x $4\frac{1}{4}$	$6\frac{1}{4}$ ounces	\$2 50	\$0 25
0	$\frac{3}{4}$ x $\frac{5}{16}$ x $4\frac{1}{2}$	$6\frac{3}{4}$ ounces	2 50	25
1	$1\frac{1}{8}$ x $\frac{1}{2}$ x 6	$20\frac{1}{2}$ ounces	3 00	25
2	$1\frac{3}{8}$ x $\frac{1}{2}$ x 6	24 ounces	3 00	25
3	$1\frac{1}{2}$ x $\frac{3}{4}$ x 8	$52\frac{1}{2}$ ounces	4 00	40
4	2 x 1 x 8	6 pounds	6 00	50
5	$2\frac{1}{4}$ x 1 x 9	6 pounds	7 00	50
6	$2\frac{3}{4}$ x $1\frac{1}{4}$ x 10	.....	9 00	75

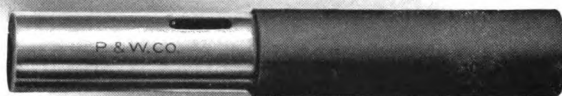
Mushet Steel Cutters for Holders No. 1 to No. 6

No. 1, each.....	\$0 95
No. 2, each.....	95
No. 3, each.....	1 20
No. 4, each.....	3 40
No. 5, each.....	3 40
No. 6, each.....	7 60

In ordering cutter, state whether diamond point or side tools are wanted, and right- or left-hand.

Steel Sockets—Style C

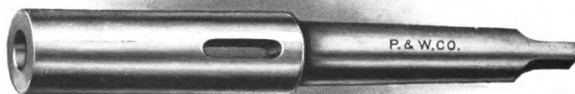
For Taper Shank Drills



No. 1. Holds $\frac{1}{4}$ to $1\frac{9}{32}$ inches, inclusive; entire length, 7 inches; diameter of blank end, $1\frac{1}{8}$ inches.....	\$1 20
No. 2. Holds $\frac{3}{8}$ to $\frac{3}{4}$ inches, inclusive; entire length, 8 inches; diameter of blank end, $1\frac{1}{4}$ inches.....	1 80
No. 3. Holds $\frac{3}{4}$ to $1\frac{1}{4}$ inches, inclusive; entire length, 10 inches; diameter of blank end, $1\frac{1}{2}$ inches.....	2 50
No. 4. Holds $1\frac{1}{4}$ to 2 inches, inclusive; entire length, 13 inches; diameter of blank end, 2 inches.....	4 00
No. 5. Holds $2\frac{1}{8}$ to 3 inches, inclusive; entire length, 15 inches; diameter of blank end, $2\frac{1}{2}$ inches.....	7 50
No. 6. Holds $3\frac{1}{8}$ to 4 inches, inclusive; entire length, 18 inches; diameter of blank end, 3 inches.....	14 00

Steel Sockets—Style A

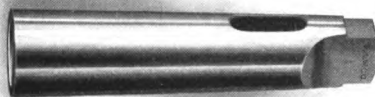
For Morse Taper Shank Drills



No. 1. With shank fitted to No. 2 socket.....	\$2 00
No. 1. With shank fitted to No. 3 socket.....	2 50
No. 2. With shank fitted to No. 3 socket.....	2 50
No. 2. With shank fitted to No. 4 socket.....	3 20
No. 3. With shank fitted to No. 4 socket.....	3 20
No. 4. With shank fitted to No. 5 socket.....	4 80
No. 5. With shank fitted to No. 6 socket.....	12 00

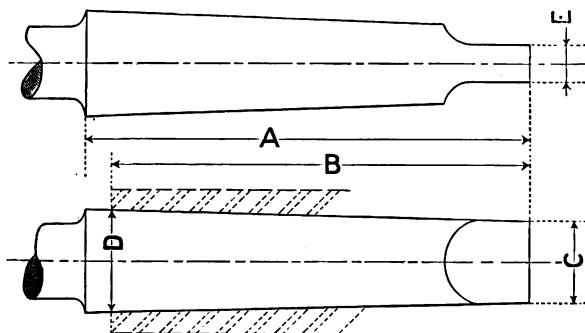
Steel Sleeves—Style B

For Morse Taper Shank Drills



No. 1.	Fitted to No. 2 socket.....	\$1 80
No. 1.	Fitted to No. 3 socket.....	2 40
No. 1.	Fitted to No. 4 socket.....	3 00
No. 2.	Fitted to No. 3 socket.....	2 40
No. 2.	Fitted to No. 4 socket.....	3 00
No. 3.	Fitted to No. 4 socket.....	3 00
No. 4.	Fitted to No. 5 socket.....	4 40

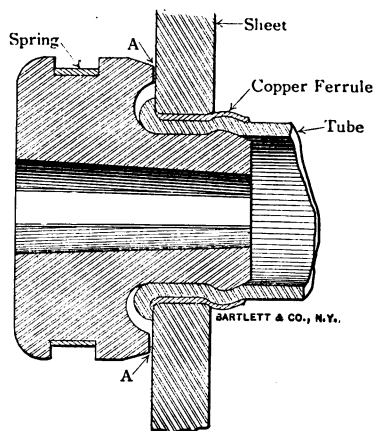
Morse Taper Shanks



Dimensions

No.	A	B	C	D	E	Taper in 12-inch
1	$2\frac{9}{16}$	$2\frac{3}{8}$	.356	.475	$1\frac{3}{8}$	.600
2	$3\frac{1}{16}$	$2\frac{7}{8}$	.556	.700	$1\frac{1}{4}$	.602
3	$3\frac{3}{4}$	$3\frac{9}{16}$	.759	.938	$1\frac{5}{16}$	.602
4	$4\frac{3}{4}$	$4\frac{1}{2}$	.997	1.231	$1\frac{5}{8}$	.623
5	6	$5\frac{3}{4}$	1.446	1.748	$1\frac{7}{8}$	.630
6	$8\frac{5}{16}$	8	2.077	2.494	$2\frac{1}{4}$	.626

Improved Flue Beading Tool For Locomotive Boilers



The illustration shows a new tool for forming the inside bead in boiler tubes in fire-box sheets. By its use the center line of the bead is kept in one positive position as the expander is rotated. The points *A-A* coming up against sheet prevent the expander changing its position horizontally, thus insuring a perfect contact between the tube and the sheet.

The expanders are furnished for $\frac{1}{2}$ -inch sheets unless otherwise ordered.

Wherever other forms than that shown are wanted, please furnish templates.

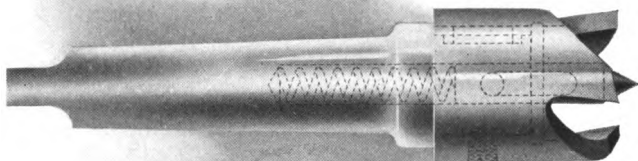
Price List

No.	Diam. of Tube Inches	Price Each	No.	Diam. of Tube Inches	Price Each
....	1	\$8 00	10	$2\frac{1}{4}$	\$13 00
2	$1\frac{1}{4}$	8 00	12	$2\frac{1}{2}$	15 00
4	$1\frac{1}{2}$	9 00	..	$2\frac{3}{4}$	18 00
6	$1\frac{3}{4}$	11 00	..	3	22 00
8	2	12 00			

The prices above include one mandrel with each expander.

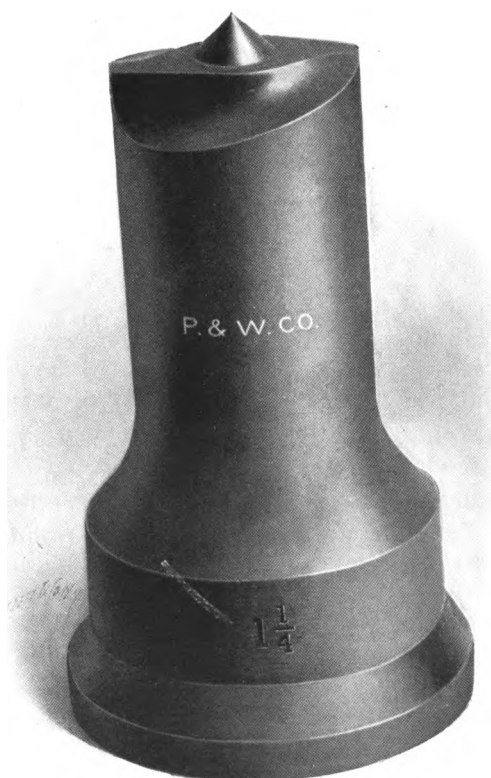
Flue Hole Cutters

With Receding Center

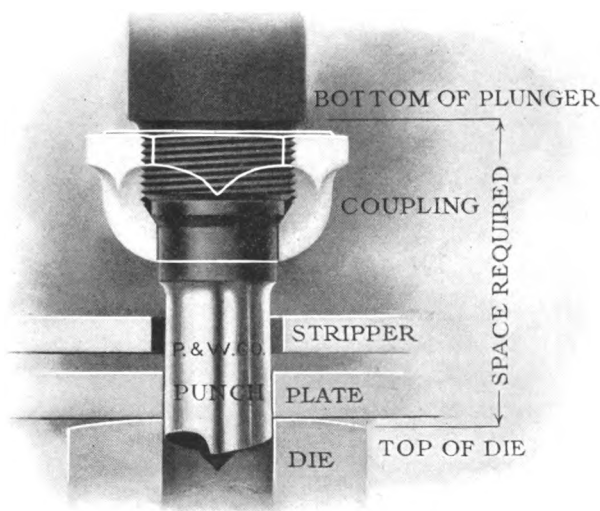


Shank	Price of Tool Complete	Diameter of Cutters	Price of Cutters Only
"A" with No. 3 Morse Taper Shank	\$15 00	1 3/4	\$8 00
	16 00	1 7/8	9 00
	17 00	2	10 00
	18 00	2 1/8	11 00
	19 00	2 1/4	12 00
"B" with No. 4 Morse Taper Shank	17 00	1 3/4	8 00
	18 00	1 7/8	9 00
	19 00	2	10 00
	20 00	2 1/8	11 00
	21 00	2 1/4	12 00
"C" with No. 4 Morse Taper Shank	22 00	2 3/8	12 00
	23 00	2 1/2	13 00
	24 00	2 5/8	14 00
	25 00	2 3/4	15 00
	26 00	2 7/8	16 00
	27 00	3	17 00
"D" with No. 5 Morse Taper Shank	18 00	1 3/4	8 00
	19 00	1 7/8	9 00
	20 00	2	10 00
	21 00	2 1/8	11 00
	22 00	2 1/4	12 00
"E" with No. 5 Morse Taper Shank	25 00	2 3/8	12 00
	26 00	2 1/2	13 00
	27 00	2 5/8	14 00
	28 00	2 3/4	15 00
	29 00	2 7/8	16 00
	30 00	3	17 00

Punch Section



Standard Punches



This cut shows the positions of punch, plunger and die, when the space between the bottom of plunger and top of die is measured. Also the positions of the stock, punch and coupling, and the correct position of the stripper relative to the punch and plate, in use, to prevent the plate from binding when the punch is drawn.

Space Required between Bottom of Plunger, When Down, and
Top of Die, for Standard Punches

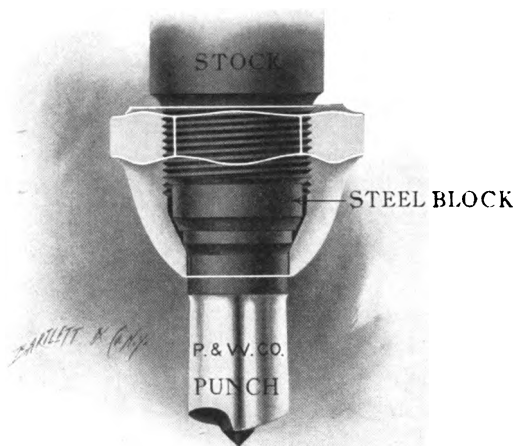
No. 2 punch.....	1 $\frac{7}{8}$ inches
No. 3 punch.....	2 $\frac{3}{16}$ inches
No. 4 punch.....	2 $\frac{3}{16}$ inches
No. 5 punch.....	2 $\frac{3}{8}$ inches
No. 6 punch.....	3 $\frac{1}{4}$ inches
No. 7 punch.....	3 $\frac{9}{16}$ inches
No. 8 punch.....	3 $\frac{7}{8}$ inches
No. 9 punch.....	4 inches
No. 10 punch.....	4 $\frac{1}{8}$ inches
No. 11 punch.....	4 $\frac{1}{4}$ inches
No. 12 punch.....	5 inches

Patent Reducing Couplings

We call special attention to the patent reducing coupling, by which punches of short lengths and small diameters can be adjusted to stocks made for larger punches. Heretofore the changing of punches of large diameters for smaller ones has necessitated the use of stocks of various sizes and lengths. With the use of the patent coupling, one stock will do for many lengths and diameters.

Example.—A machine fitted up to punch $1\frac{1}{2}$ -inch holes, using No. 7 punch, which is 3 inches long, the operator wishing to punch $\frac{3}{4}$ -inch hole, and use a No. 4 punch, which is $1\frac{1}{2}$ inches long, takes off the regular No. 7 coupling, and in its place puts the 7-4 long reducing coupling, with the steel block and the No. 4 punch. This coupling maintains the length required for the No. 7 punch, by use of the steel block (see cut, page 154). Heretofore the No. 7 stock has been removed and the No. 4 stock put in its place, thus requiring two stocks and using much time in arranging. We also have the small hole, or short reducing coupling, that is used where there is no need of maintaining the length. The example would be the same as for the long reducing coupling, except that no steel block would be used, and the difference in the length would be equal to the difference in the length of punch; and the operator, if using a No. 7 punch, and wishing to change to a No. 4, should take into account the difference in length between the No. 7 and the No. 4 punch, which is $1\frac{1}{2}$ inches. These couplings are especially desirable on the small sizes, No. 2 to No. 4, and the large sizes, No. 8 to No. 12. The distance from point of punch to coupling *is the same*, whether long, short or regular coupling is used.

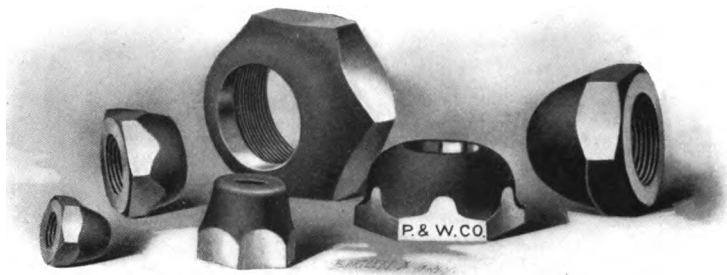
Standard Reducing Couplings



Dimensions and Prices

Nos. of Couplings	Diameter of Thread Inches	Price, Each of Short Coupling	Price, Each Long, with Steel Block	Price, Each of Steel Block	Plain Holes Inches
3-2	$\frac{7}{8}$	\$1 25	\$1 75	\$0 50	$\frac{7}{8}$
4-3	$1 \frac{1}{8}$	1 50	2 00	50	$\frac{5}{8}$
4-2	$1 \frac{1}{8}$	1 50	2 00	50	$\frac{7}{8}$
5-4	$1 \frac{5}{8}$	1 75	2 50	50	$\frac{13}{16}$
5-3	$1 \frac{5}{8}$	1 75	2 50	50	$\frac{1}{6}$
5-2	$1 \frac{5}{8}$	1 75	2 50	50	$\frac{9}{8}$
6-5	$1 \frac{9}{8}$	2 00	2 75	50	$\frac{7}{6}$
6-4	$1 \frac{9}{8}$	2 00	3 00	75	$1 \frac{1}{8}$
6-3	$1 \frac{9}{8}$	2 00	3 00	75	$\frac{13}{16}$
7-6	$1 \frac{7}{8}$	2 50	3 00	50	$\frac{1}{6}$
7-5	$1 \frac{7}{8}$	2 50	3 25	50	$\frac{9}{8}$
7-4	$1 \frac{7}{8}$	2 50	3 75	1 00	$1 \frac{1}{6}$
7-3	$1 \frac{7}{8}$	2 50	3 75	1 00	$\frac{13}{16}$
8-7	$2 \frac{1}{4}$	3 50	4 50	75	$\frac{9}{8}$
8-6	$2 \frac{1}{4}$	3 50	4 75	1 00	$1 \frac{9}{16}$
9-8	$2 \frac{3}{4}$	4 00	5 50	1 00	$1 \frac{1}{4}$
11-10	$3 \frac{7}{8}$	5 50	6 00	1 00	$1 \frac{3}{8}$
11-9	$3 \frac{7}{8}$	5 50	6 75	1 00	$2 \frac{1}{8}$
12-11	$4 \frac{7}{8}$	6 00	7 50	1 00	$2 \frac{5}{8}$
12-10	$4 \frac{7}{8}$	6 00	8 00	1 00	$3 \frac{5}{8}$
12-9	$4 \frac{7}{8}$	6 00	7 50	1 00	$2 \frac{1}{6}$

Standard Punch Couplings



Dimensions and Prices

No. of Coupling	Price Each	Diameter of Thread Inches	Largest Outside Diameter of Coupling Inches	Plain Hole Inches
2	\$1 00	$1\frac{1}{16}$	$1\frac{9}{32}$	$\frac{7}{16}$
3	1 25	$\frac{7}{8}$	$1\frac{1}{16}$	$\frac{3}{8}$
4	1 50	$1\frac{1}{16}$	$1\frac{5}{16}$	$\frac{13}{16}$
5	1 75	$1\frac{5}{16}$	$2\frac{1}{4}$	$1\frac{1}{16}$
6	2 00	$1\frac{9}{16}$	$2\frac{3}{8}$	$1\frac{1}{4}$
7	2 50	$1\frac{7}{8}$	$2\frac{5}{8}$	$1\frac{9}{16}$
8	3 25	$2\frac{1}{4}$	$3\frac{1}{2}$	$1\frac{13}{16}$
9	4 00	$2\frac{3}{4}$	$4\frac{3}{8}$	$2\frac{5}{8}$
10	4 75	$3\frac{1}{4}$	$4\frac{7}{8}$	$2\frac{11}{16}$
11	5 50	$3\frac{7}{8}$	$5\frac{3}{4}$	$3\frac{5}{8}$
12	6 00	$4\frac{7}{8}$	$7\frac{1}{8}$	$4\frac{3}{16}$

Flat and Spiral Punches for Rivet Work

Standard Dimensions and Prices

No. of Punch	Size of Rivet Inches	Size of Punch Inches	Size of Head on Punch Inches	Flat Punches		Spiral Punches	
				Length Over All Inches	Price per Doz.	Length Over All Inches	Price per Doz.
2	$\frac{3}{16}$.21	$1\frac{1}{32}$	$1\frac{9}{32}$	\$4 00	$1\frac{5}{16}$	\$4 50
2	$\frac{1}{4}$	.28	$1\frac{1}{16}$	$1\frac{9}{32}$		$1\frac{5}{16}$
2	$\frac{5}{16}$	.34	$1\frac{1}{8}$	$1\frac{9}{32}$		$1\frac{5}{16}$
2	$\frac{3}{8}$	.41	$1\frac{1}{4}$	$1\frac{9}{32}$		$1\frac{5}{16}$
3	$\frac{3}{8}$.21	$1\frac{1}{8}$	$1\frac{3}{2}$	4 50	$1\frac{9}{16}$	5 50
3	$\frac{1}{4}$	.28	$1\frac{3}{8}$	$1\frac{3}{2}$		$1\frac{9}{16}$
3	$\frac{5}{16}$	.34	$1\frac{1}{2}$	$1\frac{3}{2}$		$1\frac{9}{16}$
3	$\frac{3}{8}$	.41	$1\frac{3}{4}$	$1\frac{3}{2}$		$1\frac{9}{16}$
3	$\frac{1}{2}$.47	$1\frac{7}{8}$	$1\frac{3}{2}$	7 00	$1\frac{9}{16}$	8 00
3	$\frac{5}{8}$	.55	$1\frac{7}{8}$	$1\frac{3}{2}$		$1\frac{9}{16}$
3	$\frac{1}{2}$	.62	$1\frac{7}{8}$	$1\frac{3}{2}$		$1\frac{9}{16}$
3	$\frac{3}{4}$	.69	$1\frac{7}{8}$	$1\frac{3}{2}$		$1\frac{9}{16}$
4	$\frac{3}{8}$.41	$1\frac{1}{2}$	$1\frac{1}{2}$	10 00	$2\frac{1}{8}$	12 00
4	$\frac{1}{4}$	.47	$1\frac{1}{2}$	$1\frac{1}{2}$		$2\frac{1}{8}$
4	$\frac{5}{16}$	.55	$1\frac{1}{2}$	$1\frac{1}{2}$		$2\frac{1}{8}$
4	$\frac{3}{8}$	.62	$1\frac{1}{2}$	$1\frac{1}{2}$		$2\frac{1}{8}$
4	$\frac{1}{2}$.74	$1\frac{1}{2}$	$1\frac{1}{2}$	14 00	$2\frac{3}{8}$	16 50
4	$\frac{5}{8}$	.80	$1\frac{1}{2}$	$1\frac{1}{2}$		$2\frac{3}{8}$
4	$\frac{3}{4}$	.86	$1\frac{1}{2}$	$1\frac{1}{2}$		$2\frac{3}{8}$
4	$\frac{7}{8}$	.94	$1\frac{1}{2}$	$1\frac{1}{2}$		$2\frac{3}{8}$
5	$\frac{1}{2}$.55	$1\frac{5}{8}$	$1\frac{5}{8}$	19 00	$2\frac{5}{8}$	23 00
5	$\frac{9}{16}$	.62	$1\frac{5}{8}$	$1\frac{5}{8}$		$2\frac{5}{8}$
5	$\frac{5}{8}$	.69	$1\frac{5}{8}$	$1\frac{5}{8}$		$2\frac{5}{8}$
5	$\frac{11}{16}$	.74	$1\frac{5}{8}$	$1\frac{5}{8}$		$2\frac{5}{8}$
5	$\frac{3}{4}$.80	$1\frac{5}{8}$	$1\frac{5}{8}$	23 00	$2\frac{5}{8}$	23 00
5	$\frac{7}{8}$	.86	$1\frac{5}{8}$	$1\frac{5}{8}$		$2\frac{5}{8}$
5	$\frac{15}{16}$	.94	$1\frac{5}{8}$	$1\frac{5}{8}$		$2\frac{5}{8}$
5	$1\frac{1}{16}$	1.00	$1\frac{5}{8}$	$1\frac{5}{8}$		$2\frac{5}{8}$	
6	$\frac{5}{8}$.69	$1\frac{3}{4}$	$1\frac{3}{4}$	23 00	$2\frac{5}{8}$	23 00
6	$\frac{11}{16}$	.74	$1\frac{3}{4}$	$1\frac{3}{4}$		$2\frac{5}{8}$
6	$\frac{3}{4}$	.80	$1\frac{3}{4}$	$1\frac{3}{4}$		$2\frac{5}{8}$
6	$\frac{13}{16}$	.86	$1\frac{3}{4}$	$1\frac{3}{4}$		$2\frac{5}{8}$
6	$\frac{7}{8}$.94	$1\frac{3}{4}$	$1\frac{3}{4}$	23 00	$2\frac{5}{8}$	23 00
6	$\frac{15}{16}$	1.00	$1\frac{3}{4}$	$1\frac{3}{4}$		$2\frac{5}{8}$	
6	$1\frac{1}{16}$	1.06	$1\frac{3}{4}$	$1\frac{3}{4}$		$2\frac{5}{8}$	
6	$1\frac{1}{8}$	1.06	$1\frac{3}{4}$	$1\frac{3}{4}$		$2\frac{5}{8}$	
7	$\frac{15}{16}$	1.00	$1\frac{1}{2}$	$2\frac{1}{2}$	23 00	$3\frac{1}{8}$	23 00
7	$1\frac{1}{8}$	1.06	$1\frac{1}{2}$	$2\frac{1}{2}$		$3\frac{1}{8}$	

Dimensions and Prices of Flat and Spiral Punches, Fractional Sizes

No. of Punch	Sizes of Punches Inches	Size of Head on Punch Inches	Flat Punch		Spiral Punch	
			Length Over All Inches	Price Each	Length Over All Inches	Price Each
2	$\frac{1}{8}$ to $\frac{3}{8}$	$\frac{1}{32}$	$1\frac{9}{32}$	\$0 35	$1\frac{5}{16}$	\$0 38
3	$\frac{1}{8}$ to $\frac{9}{16}$	$\frac{3}{32}$	$1\frac{1}{2}$	40	$1\frac{9}{16}$	50
4	$\frac{1}{4}$ to $\frac{3}{4}$	$\frac{1}{16}$	$1\frac{1}{2}$	60	$1\frac{5}{8}$	70
5	$\frac{3}{8}$ to 1	$\frac{1}{8}$	$1\frac{5}{8}$	90	$2\frac{1}{8}$	1 05
6	$\frac{1}{2}$ to $1\frac{3}{16}$	$\frac{1}{8}$	$2\frac{3}{8}$	1 20	$2\frac{5}{8}$	1 40
7	$\frac{3}{4}$ to $1\frac{1}{2}$	$\frac{1}{4}$	$2\frac{1}{2}$	1 60	3	1 95
8	1 to $1\frac{3}{4}$	$\frac{1}{2}$	....	2 50	$3\frac{3}{8}$	3 00
9	$1\frac{1}{2}$ to $2\frac{1}{4}$	$\frac{3}{4}$	....	....	$3\frac{7}{8}$	4 00
10	2 to $2\frac{5}{8}$	$\frac{1}{2}$	....	....	$3\frac{1}{2}$	9 00
11	$2\frac{1}{2}$ to $3\frac{1}{4}$	$\frac{3}{4}$	....	....	$3\frac{7}{8}$	15 00
12	$3\frac{1}{4}$ to $4\frac{1}{8}$	$1\frac{1}{2}$	....	....	4	22 00

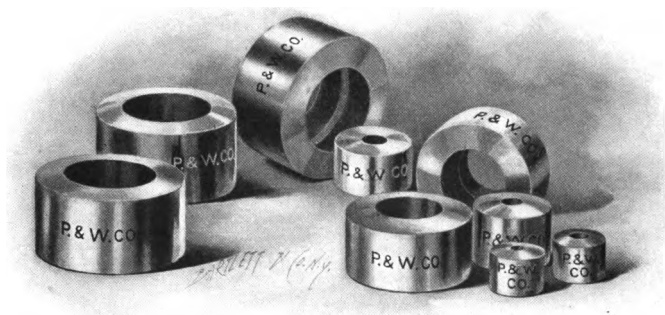
When ordered by the dozen, price will be the same as corresponding sizes on page 156.

Less than six of a size will be charged as single punches.

Special lengths and diameters made to order.

Blank order slips furnished on application.

Standard Punch Dies



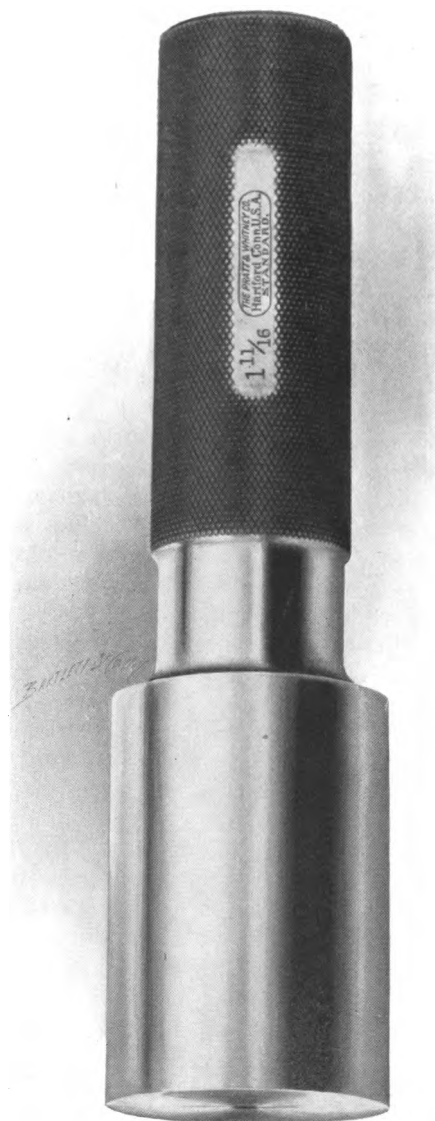
Dimensions and Prices

Outside Dimensions			Hole Diameters Correct Size for Punches Inches	Price Each
No. of Die	Diameter of Die Inches	Thickness of Die Inches		
2	$\frac{3}{4}$	$\frac{5}{8}$	From $\frac{1}{8}$ to $\frac{5}{16}$	\$0 75
3	1	$\frac{3}{4}$	From $\frac{1}{8}$ to $\frac{9}{16}$	1 00
4	$1\frac{1}{2}$	1	From $\frac{1}{4}$ to $\frac{3}{4}$	1 50
5	2	1	From $\frac{1}{4}$ to 1	2 00
6	$2\frac{3}{8}$	$1\frac{1}{4}$	From $\frac{1}{2}$ to $1\frac{1}{4}$	2 50
7	$2\frac{7}{8}$	$1\frac{1}{4}$	From $\frac{3}{4}$ to $1\frac{9}{16}$	4 50

Other sizes made to order at special prices, which will be furnished upon application.



*Standard Measuring Machines, Standard Size and
Thread Gauges, and Gauges for Special Purposes*



United States Standard Screw Thread System

In order to extend the general adoption of a standard system of screw threads throughout the United States, the importance of which is fully acknowledged by the engineering profession, the Pratt & Whitney Company has, at great expense and by the employment of the best methods attainable, endeavored to solve the problem in regard to producing standard gauges, both United States Standard or Franklin Institute threads, and for standard sizes, the latter being naturally the foundation of the entire system; and with the facilities now at command, can furnish gauges which are interchangeable as to size, and correct in angle and pitch of the thread.

The Sellers system, recommended by the Franklin Institute, of Philadelphia, has been adopted by the United States Government, the Master Mechanics' and Master Car Builders' associations, locomotive works, machine-bolt makers, and by many manufacturing establishments throughout the country. The thread has an angle of 60 degrees, with flat top and bottom equal to one-eighth of the pitch. The advantages of this form of thread over the sharp "V" are that, in the tap, the edges of the thread are less liable to accidental injury, and will wear and retain their size and form longer, and, in the bolt, the flat top and bottom give increased strength and an improved appearance, while the greater facility with which practical uniformity and consequent interchangeability are now attained by its use, as compared with the Whitworth form, will commend it to the attention of every user of taps and dies, wherever its application may be possible.

The sketches in section, pages 6, 7 and 8, show the form of threads referred to.

The table on following page gives the standard diameter and number of threads per inch for all usual sizes, from $\frac{1}{4}$ inch to 6 inches, inclusive.

Sellers or U. S. Standard

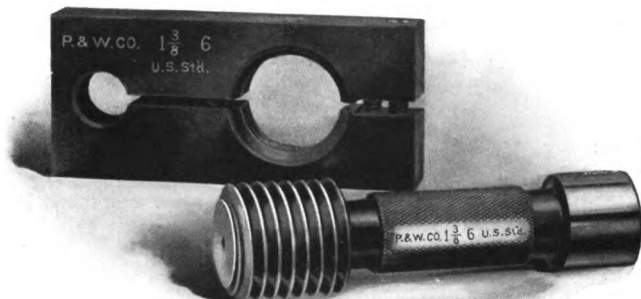
Diameter Inches	Number Threads per Inch	Diameter Inches	Number Threads per Inch	Diameter Inches	Number Threads per Inch	Diameter Inches	Number Threads per Inch
$\frac{1}{4}$	20	$1\frac{1}{2}$	6	$3\frac{1}{8}$	$3\frac{1}{2}$	$4\frac{5}{8}$	$2\frac{5}{8}$
$\frac{5}{16}$	18	$1\frac{3}{8}$	$5\frac{1}{2}$	$3\frac{1}{4}$	$3\frac{1}{2}$	$4\frac{3}{4}$	$2\frac{3}{8}$
$\frac{3}{8}$	16	$1\frac{1}{4}$	5	$3\frac{3}{8}$	$3\frac{1}{4}$	$4\frac{7}{8}$	$2\frac{5}{8}$
$\frac{7}{16}$	14	$1\frac{1}{8}$	5	$3\frac{1}{2}$	$3\frac{1}{4}$	5	$2\frac{1}{2}$
$\frac{1}{2}$	13	2	$4\frac{1}{2}$	$3\frac{5}{8}$	$3\frac{1}{4}$	$5\frac{1}{8}$	$2\frac{1}{2}$
$\frac{9}{16}$	12	$2\frac{1}{8}$	$4\frac{1}{2}$	$3\frac{3}{4}$	3	$5\frac{1}{4}$	$2\frac{1}{2}$
$\frac{5}{8}$	11	$2\frac{1}{4}$	$4\frac{1}{2}$	$3\frac{7}{8}$	3	$5\frac{3}{8}$	$2\frac{3}{8}$
$\frac{3}{4}$	10	$2\frac{3}{8}$	4	4	3	$5\frac{1}{2}$	$2\frac{3}{8}$
$\frac{7}{8}$	9	$2\frac{1}{2}$	4	$4\frac{1}{8}$	$2\frac{7}{8}$	$5\frac{5}{8}$	$2\frac{3}{8}$
1	8	$2\frac{5}{8}$	4	$4\frac{1}{4}$	$2\frac{7}{8}$	$5\frac{3}{4}$	$2\frac{3}{8}$
$1\frac{1}{8}$	7	$2\frac{3}{4}$	4	$4\frac{3}{8}$	$2\frac{3}{4}$	$5\frac{7}{8}$	$2\frac{1}{4}$
$1\frac{1}{4}$	7	$2\frac{7}{8}$	$3\frac{1}{2}$	$4\frac{1}{2}$	$2\frac{3}{4}$	6	$2\frac{1}{4}$
$1\frac{3}{8}$	6	3	$3\frac{1}{2}$				

Screws and bolts $\frac{11}{16}$, $\frac{13}{16}$ and $\frac{15}{16}$ -inch diameter are usually made, having 11, 10 and 9 threads per inch, respectively; but under the Sellers formula, strictly followed, they should be 10, 9 and 8, respectively.

U. S. Standard Thread Gauges

External and Internal

Hardened and Not Ground in the Angle of the Thread



These gauges are intended as practical working standards, the internal gauge or plug being the standard to which the external templet is adjusted, means for which are fully provided. The thread is exact size outside diameter, and flat at top one-eighth the pitch; the angle of the thread being 60 degrees gives the correct size in the angle or sides of the thread, the bottom being left sharp to give the clearance necessary in using the gauge. The end opposite the thread furnishes the exact diameter at the root or bottom of the U. S. Standard thread, and is ground and lapped to standard size, as is also the outside diameter of the thread. (For U. S. Standard tap drill sizes, see page 199.)

Size Inches	Price of Plug and Templet	Size Inches	Price of Plug and Templet	Size Inches	Price of Plug and Templet
1/4	\$7 50	7/8	\$11 50	2	\$21 00
5/16	7 50	1 1/8	11 50	2 1/8	23 00
3/8	8 00	1	12 50	2 1/4	25 00
7/16	8 00	1 1/8	13 50	2 3/8	27 00
1/2	8 50	1 1/4	14 50	2 1/2	29 00
9/16	8 50	1 3/8	15 50	2 5/8	31 00
5/8	9 50	1 1/2	16 25	2 3/4	33 50
11/16	9 50	1 5/8	17 25	2 7/8	36 00
3/4	10 50	1 3/4	18 25	3	38 50
13/16	10 50	1 7/8	19 50		

Plugs ordered separately, 60 per cent of above list.

Templets ordered separately, 40 per cent of above list.

Sizes above 3 inches and special thread gauges, U. S. form of thread, made to order, at prices which will be quoted on application.

Left-hand U. S. thread gauges, 25 per cent advance on corresponding list prices.

"V" form thread gauges, 60-degree angle, U. S. Standard pitches, 10 per cent advance on corresponding list prices.

Right-hand Whitworth Standard thread gauges, 35 per cent advance on corresponding list prices.

U. S. Standard Thread Gauges External and Internal

Hardened and Ground in the Angle of the Thread

Prices Furnished on Application

(See illustration on page 165, representing these gauges)

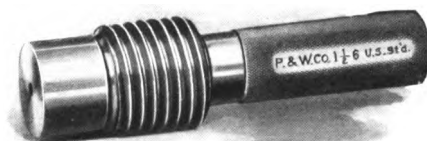
These gauges are hardened and ground in the angle of the thread by a process which leaves the pitch and angle correct, and does not round the edges of the thread. This form of thread gauge is recommended when a highly-finished and more accurate gauge is required, combined with the best possible conditions as to wearing qualities and convenience.

Gauges for special threads, U. S. form, of this degree of precision, made to order.

GAUGES, HARDENED AND GROUND, variations corrected in lead after hardening, for standard threads for any purpose requiring accuracy and interchangeability in the fitting of threaded parts, made to order. Our plant for this class of work is complete, and all work warranted. Prices given upon application, with specifications of form and size of gauge required.

U. S. Standard Reference Thread Gauges

Unhardened Steel



These U. S. Standard Thread gauges are intended for use as a final reference gauge, using *calipers only* in measuring from them. They are made with special care, being standard in every respect, and represent exactly, in every detail, the Sellers, Franklin Institute or U. S. Standard thread, but are not hardened. They are recommended for use as standards to which the working gauges should be referred, especially where several sets of working gauges are used, to detect tampering or possible wear of the gauges in actual use.

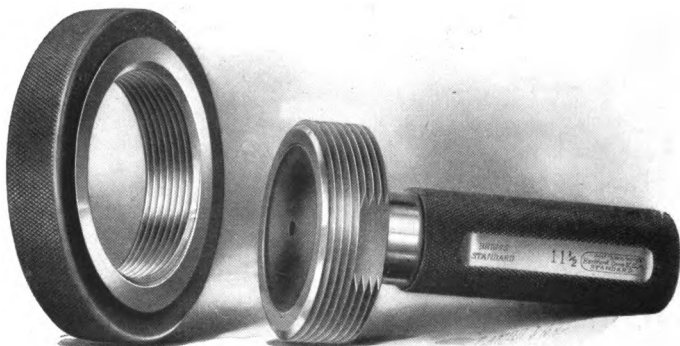
A set of U. S. Standard Thread gauges of this form, from $\frac{1}{4}$ inch to 2 inches, has been furnished the Master Car Builders' Association on their requisition, and adopted by them as ultimate standards of reference in cases of disputed thread sizes.

Size Inches	Price Plug Only	Size Inches	Price Plug Only	Size Inches	Price Plug Only
$\frac{1}{4}$	\$7 50	$\frac{7}{8}$	\$11 50	2	\$21 00
$\frac{5}{16}$	7 50	$\frac{15}{16}$	11 50	$2\frac{1}{8}$	23 00
$\frac{3}{8}$	8 00	1	12 50	$2\frac{1}{4}$	25 00
$\frac{7}{8}$	8 00	$1\frac{1}{8}$	13 50	$2\frac{3}{8}$	27 00
$\frac{1}{2}$	8 50	$1\frac{1}{4}$	14 50	$2\frac{1}{2}$	29 00
$\frac{1}{16}$	8 50	$1\frac{3}{8}$	15 50	$2\frac{5}{8}$	31 00
$\frac{5}{8}$	9 50	$1\frac{1}{2}$	16 25	$2\frac{3}{4}$	33 50
$\frac{11}{16}$	9 50	$1\frac{5}{8}$	17 25	$2\frac{7}{8}$	36 00
$\frac{3}{4}$	10 50	$1\frac{3}{4}$	18 25	3	38 50
$\frac{13}{16}$	10 50	$1\frac{7}{8}$	19 50		

Sizes above 3 inches, and special thread gauges, made to order at prices quoted on application. Sent securely packed in finished cherry cases, especially made for them, in sets or separately, as per above list. Discount for sets quoted on application.

Pipe Thread Gauges, Briggs Standard

External and Internal



These gauges represent accurately the sizes and pitches of pipe threads for all diameters, from $\frac{1}{8}$ inch upwards, as established by the late Robert Briggs, C. E., in 1862. This standard system has since been generally used and was formally adopted by the manufacturers of wrought-iron pipe and boiler tubes in the United States, at their meeting held in Pittsburg, October 27, 1886, and was confirmed at a meeting held in New York, May 9, 1889, excepting by amending the list to exclude 9-inch, which is changed from 9.688-inch to 9.625-inch, outside diameter; also adopted by the Association of Manufacturers of Brass and Iron, Steam, Gas and Water Works of the United States, in convention, New York, December 8, 1886.

Briggs Standard Pipe Thread Gauges, Plugs and Templets

$\frac{3}{4}$ -inch Taper per Foot

Hardened and Not Ground in the Angle of the Thread

Plugs for all sizes from $\frac{1}{8}$ to $3\frac{1}{2}$ inches, inclusive, made from solid steel.

Rings for all sizes from $\frac{1}{8}$ to $2\frac{1}{2}$ inches, inclusive, made from solid steel.

Rings for all sizes from 3 to 9 inches, inclusive, made from solid steel, pressed into an outer cast-iron ring.

Plugs for all sizes from 4 to 9 inches, inclusive, have a solid steel ring forced onto a conical cast-iron center with handle.

Plugs and rings for all sizes from 10 to 24 inches, inclusive, are built-up gauges having steel threaded sections fitted to cast-iron bodies.

Size Inches	Price of Plug and Templet	Size Inches	Price of Plug and Templet
$\frac{1}{8}$	\$8 50	$3\frac{1}{2}$	\$32 00
$\frac{1}{4}$	10 50	4	34 50
$\frac{3}{8}$	12 50	$4\frac{1}{2}$	38 00
$\frac{1}{2}$	14 50	5	41 50
$\frac{3}{4}$	16 50	6	46 00
1	18 50	7	82 00
$1\frac{1}{4}$	20 50	8	94 00
$1\frac{1}{2}$	22 50	9	108 00
2	24 50	10	126 00
$2\frac{1}{2}$	27 00	11	145 00
3	29 50	12	165 00

Left-hand gauges, 25 per cent advance on corresponding list prices.

Plugs or templets ordered separately, each 50 per cent of above list.

Prices quoted on application for sizes above 12 inches.

Hardened steel gauges, representing the exact size of the thread in fittings, with allowance for screwing up with tongs for a steam-tight joint, using pipe cut to the Briggs standard, made to order.

For comprehensive information regarding the subject of standard pipe and pipe threads, as applied to American practice, we would refer all who may be interested to the Excerpt Minutes of Proceedings of the Institution of Civil Engineers of Great Britain, Vol. LXXI., Session 1882-3, Part I., containing the paper of the late Robert Briggs, C. E., presented and read after his death, on "American Practice in Warming Buildings by Steam."

The following extracts from the paper of Mr. Briggs (included more fully in the report of the committee on standard pipe and pipe threads, American Society of Mechanical Engineers, Vol. VIII., transactions) are here presented, giving data upon which the Briggs standard pipe-thread sizes are based:

"The taper employed for the conical tube ends is uniform with all makes of tubes or fittings, namely, an inclination of 1 in 32 to the axis. Custom has established also a particular length of screwed end for each different diameter of tube. Tubes of the several diameters are kept in stock by manufacturers and merchants, and form the basis of a regular trade in the apparatus for warming by steam. A knowledge of all these particulars is therefore essential for designing apparatus for the purpose. The ruling dimensions in wrought-iron tube work are the external diameters of certain nominal sizes, which are designated roughly according to their internal diameters. These nominal sizes were mainly established in the English tube trade

between 1820 and 1840, and certain pitches of screw thread were then adopted for them, the coarseness of the pitch varying roughly with the diameter, but in an arbitrary way utterly devoid of regularity. The length of the screwed portion on the tube end varies with the external diameter of the tube according to an arbitrary rule of thumb; whence results, for each size of tube, a certain minimum thickness of metal at the outer extremity of the tapering screwed tube end. It is the determination of this minimum thickness of metal, for the tapering screwed end of a wrought-iron tube, which constitutes the question of mechanical interest.

"The thread employed has an angle of 60 degrees; it is slightly rounded off, both at the top and at the bottom, so that the height or depth of the thread, instead of being exactly* equal to the pitch, is only four-fifths of the pitch, or equal to $0.8 \frac{1}{n}$ if n be the number of threads per inch. For the length of the tube end throughout which the screw thread continues perfect, the empirical formula used is $(0.8D + 4.8) \times \frac{1}{n}$, where D is the actual external diameter of the tube throughout its parallel length, and is expressed in inches. Further back, beyond the perfect threads, come two having the same taper at the bottom, but imperfect at the top. The remaining imperfect portion of the screw thread, furthest back from the extremity of the tube, is not essential in any way to this system of joint; and its imperfection is simply incidental to the process of cutting the thread at a single operation."

For dimensions, see table on page 198.

* Error in report: This should be "instead of being exactly equal to the pitch \times cosine of 30 degrees (pitch $\times 0.866$)"

Standard Oil Well Casing Gauges

$\frac{3}{8}$ -inch Taper per Foot

Plugs for all sizes from 2 to 4 inches, inclusive, are made from solid steel.

Rings for all sizes from 2 to $2\frac{3}{4}$ inches, inclusive, are made from solid steel.

Plugs for all sizes from $4\frac{1}{4}$ to $9\frac{5}{8}$ inches, inclusive, have a solid ring forced onto a conical cast-iron center with handle.

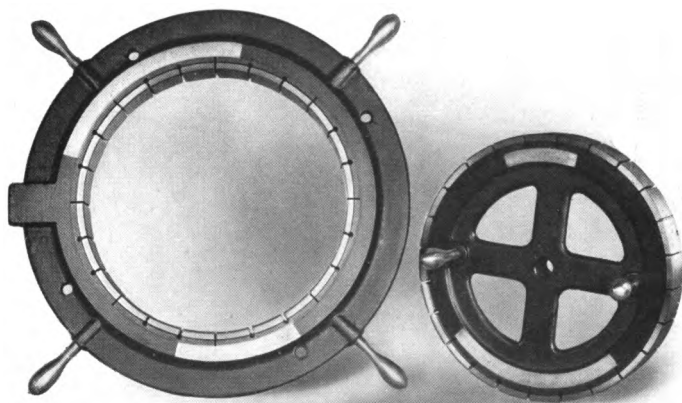
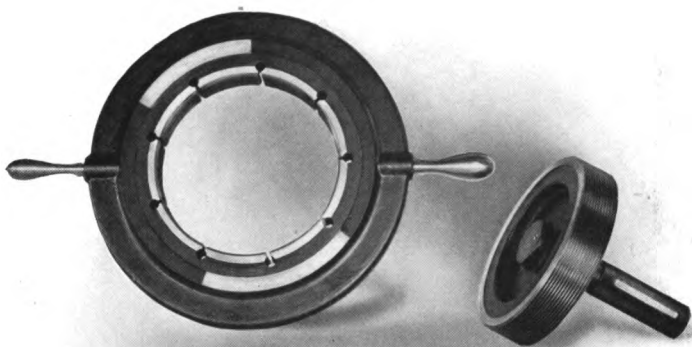
Rings for all sizes from 3 to $9\frac{5}{8}$ inches, inclusive, are made from solid steel, pressed into an outer cast-iron ring.

Plugs and rings for all sizes from $10\frac{5}{8}$ to $15\frac{1}{2}$ inches, inclusive, are built-up gauges, having steel threaded sections fitted to cast-iron bodies.

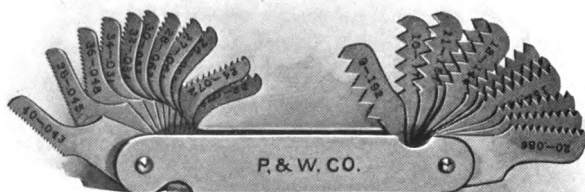
Prices quoted upon application.

For illustrations, see following page.

Oil Well Casing Gauges



Screw Pitch Gauges



No. 1. Having 22 pitches, 60-degree angle, "V" thread, as follows: 9, 10, 11, 11½, 12, 13, 14, 15, 16, 18, 20, 22, 24, 26, 27, 28, 30, 32, 34, 36, 38 and 40, each..... \$1 00

No. 2. U. S. Standard, having 25 pitches, as follows: 2¼, 2⅜, 2½, 2⅝, 2¾, 2⅞, 3, 3¼, 3½, 4, 4½, 5, 5½, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 18 and 20, each..... 1 50

No. 3. Whitworth Standard, having 26 pitches, as follows: 4, 4½, 5, 5½, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 18, 19, 20, 22, 24, 25, 26, 28 and 30, each 1 25

No. 4. French Standard, each..... 1 50

No. 5. International Standard, each..... 1 50

Precision Lead Screws

SHORT LEADING SCREWS, hardened and ground by the same process used in making U. S. Standard Thread gauges, made to order. Prices quoted upon application.

STANDARD LEADING SCREWS, for lathes, any length to 45 feet and 4 inches diameter, made to order. Our facilities for this class of work are unexcelled, and for purposes of practical accuracy, such as leading screws for lathes and special machines, the quality of the work produced will, we believe, prove satisfactory.

Standard End-measure Test Pieces

Made to Order Only

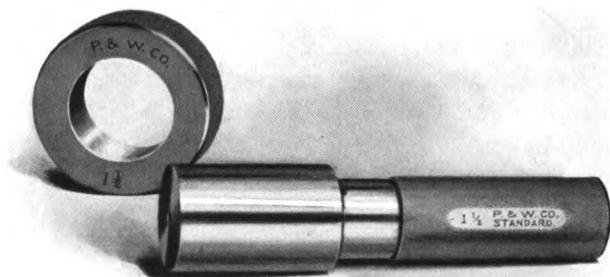
Tap Drill Sizes for U. S. Standard Thread

Size Inches	Diameter of Drill Inches	Size Inches	Diameter of Drill Inches	Size Inches	Diameter of Drill Inches
$\frac{1}{4}$	0.180	$\frac{5}{8}$	0.512	$1\frac{1}{8}$	1.167
$\frac{5}{16}$	0.244	$\frac{3}{4}$	0.625	$1\frac{1}{2}$	1.292
$\frac{3}{8}$	0.298	$\frac{7}{8}$	0.737	$1\frac{3}{4}$	1.398
$\frac{7}{16}$	0.349	1	0.844	$1\frac{7}{8}$	1.500
$\frac{1}{2}$	0.405	$1\frac{1}{8}$	0.947	1 $\frac{7}{8}$	1.625
$\frac{9}{16}$	0.459	$1\frac{1}{4}$	1.072	2	1.722

The above table gives the diameter of drills in thousandths of an inch for holes to be tapped U. S. Standard, and is an allowance above actual bottom diameter size of thread of from $\frac{4}{1000}$ of an inch for a $\frac{1}{4}$ -inch tap to $\frac{10}{1000}$ for a 2-inch tap.

Hardened steel gauges, ground and lapped to above sizes, made to order.

Standard Cylindrical Size Gauges, Plugs and Templets Hardened and Ground



These gauges are made of steel, and after being specially hardened and treated, are ground and lapped round and straight, the sizes representing accurate subdivisions of the British imperial yard, or of the standard metre.

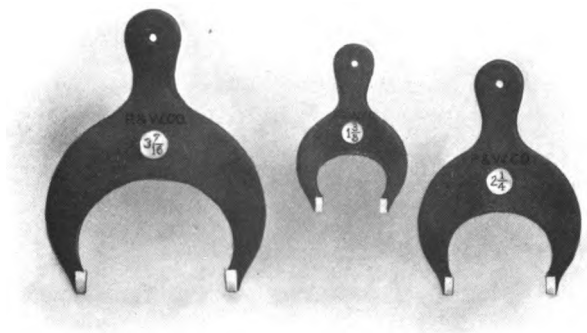
Prices of sizes by sixty-fourths, thirty-seconds, thousandths or ten-thousandths of an inch, or varying by any other subdivisions of an inch, or corresponding metric sizes, quoted on application.

Size Inches	Price of Plug and Templet	Size Inches	Price of Plug and Templet	Size Inches	Price of Plug and Templet	Size Inches	Price of Plug and Templet
$\frac{1}{16}$	\$7 40	$\frac{13}{16}$	\$9 20	$1\frac{9}{16}$	\$13 40	$2\frac{5}{16}$	\$18 70
$\frac{1}{8}$	7 40	$\frac{7}{8}$	9 40	$1\frac{5}{8}$	13 80	$2\frac{3}{8}$	19 20
$\frac{3}{16}$	7 40	$1\frac{1}{8}$	9 60	$1\frac{11}{16}$	14 20	$2\frac{7}{16}$	19 70
$\frac{1}{4}$	7 40	1	9 80	$1\frac{3}{4}$	14 60	$2\frac{1}{2}$	20 20
$\frac{5}{16}$	7 60	$1\frac{1}{16}$	10 20	$1\frac{7}{8}$	15 00	$2\frac{9}{16}$	20 70
$\frac{3}{8}$	7 80	$1\frac{1}{8}$	10 60	$1\frac{7}{8}$	15 40	$2\frac{3}{4}$	21 20
$\frac{7}{16}$	8 00	$1\frac{3}{8}$	11 00	$1\frac{5}{4}$	15 80	$2\frac{11}{16}$	21 70
$\frac{1}{2}$	8 20	$1\frac{1}{4}$	11 40	2	16 20	$2\frac{3}{4}$	22 20
$\frac{9}{16}$	8 40	$1\frac{5}{16}$	11 80	$2\frac{1}{16}$	16 70	$2\frac{13}{16}$	22 70
$\frac{5}{8}$	8 60	$1\frac{3}{8}$	12 20	$2\frac{1}{8}$	17 20	$2\frac{7}{8}$	23 20
$1\frac{1}{16}$	8 80	$1\frac{7}{8}$	12 60	$2\frac{1}{4}$	17 70	$2\frac{5}{4}$	23 70
$\frac{3}{4}$	9 00	$1\frac{1}{2}$	13 00	$2\frac{1}{2}$	18 20	3	24 20

Plugs ordered separately, 40 per cent, and rings 60 per cent of above list. Prices for special cylindrical gauges, sizes above 3 inches, and for regular sizes in sets, in English or Metric standards, quoted on application. Standard or special sets sent securely packed in finished cherry cases, made specially for them. Regular sets are $\frac{1}{16}$ to 2 inches by sixteenths, and $2\frac{1}{8}$ to 3 inches by eighths, inclusive, plugs and templets.

Drop-forged Steel Caliper Gauges

Parallel Jaws, Hardened, Ground and Lapped to Standard Size



These gauges are convenient, light, and rigid, and are intended for general shop work, replacing the expensive method of setting a spring or slide caliper to a line upon a scale, by furnishing a fixed and standard size, available at a moment's notice. In no other form of gauge is the minute difference required for interchangeability in duplicating parts so perceptible as with a "snap" gauge having parallel jaws, hardened, ground and polished, making this an available *practical* "instrument of precision," necessary in every machine shop, armory, or sewing-machine factory, where interchangeable work is demanded.

Standard cylindrical size gauges, from $\frac{1}{4}$ to 4 inches, used as standards of reference for verifying the size of each "snap" gauge, will enable the manufacturer of articles requiring duplication to keep them to size.

Drop-forged Steel Caliper Gauges

Size Inches	Price Each	Size Inches	Price Each	Size Inches	Price Each	Size Inches	Price Each
$\frac{1}{4}$	\$1 40	$1\frac{1}{4}$	\$1 60	$2\frac{3}{16}$	\$2 30	$3\frac{1}{8}$	\$3 30
$\frac{5}{16}$	1 40	$1\frac{5}{16}$	1 60	$2\frac{1}{4}$	2 30	$3\frac{3}{16}$	3 40
$\frac{3}{8}$	1 40	$1\frac{3}{8}$	1 65	$2\frac{5}{16}$	2 30	$3\frac{1}{4}$	3 40
$\frac{7}{16}$	1 40	$1\frac{7}{16}$	1 65	$2\frac{3}{8}$	2 40	$3\frac{5}{16}$	3 50
$\frac{1}{2}$	1 40	$1\frac{1}{2}$	1 70	$2\frac{7}{16}$	2 40	$3\frac{3}{8}$	3 50
$\frac{9}{16}$	1 40	$1\frac{9}{16}$	1 75	$2\frac{1}{2}$	2 50	$3\frac{7}{16}$	3 50
$\frac{5}{8}$	1 40	$1\frac{5}{8}$	1 80	$2\frac{9}{16}$	2 60	$3\frac{1}{2}$	3 50
$1\frac{1}{16}$	1 40	$1\frac{11}{16}$	1 90	$2\frac{5}{8}$	2 70	$3\frac{9}{16}$	3 75
$\frac{3}{4}$	1 45	$1\frac{3}{4}$	2 00	$2\frac{11}{16}$	2 80	$3\frac{5}{8}$	3 75
$1\frac{1}{8}$	1 45	$1\frac{13}{16}$	2 00	$2\frac{3}{4}$	2 90	$3\frac{11}{16}$	3 75
$\frac{7}{8}$	1 45	$1\frac{7}{8}$	2 10	$2\frac{13}{16}$	3 00	$3\frac{3}{4}$	3 75
$1\frac{1}{8}$	1 45	$1\frac{15}{16}$	2 10	$2\frac{7}{8}$	3 10	$3\frac{7}{8}$	4 00
1	1 50	2	2 20	$2\frac{15}{16}$	3 20	$3\frac{7}{8}$	4 00
$1\frac{1}{16}$	1 50	$2\frac{1}{16}$	2 20	3	3 30	$3\frac{15}{16}$	4 00
$1\frac{1}{8}$	1 55	$2\frac{1}{8}$	2 20	$3\frac{1}{16}$	3 30	4	4 00
$1\frac{3}{16}$	1 55						

Sets, varying by sixteenths, $\frac{1}{4}$ to 2 inches, inclusive..... \$47 00

Sets, varying by sixteenths, $\frac{1}{4}$ to 2 inches, inclusive, and
2 $\frac{1}{8}$ to 2 $\frac{1}{2}$ inches, inclusive, varying by eighths. 56 40

Sets, varying by sixteenths, $\frac{1}{4}$ to 2 $\frac{1}{2}$ inches, inclusive 65 60

Complete sets, varying by sixteenths, $\frac{1}{4}$ to 3 inches, inclu-
sive, and 3 $\frac{1}{8}$ to 4 inches, inclusive, varying by eighths 118 40

Limit Gauges for Round Iron

Master Car Builders' Standard

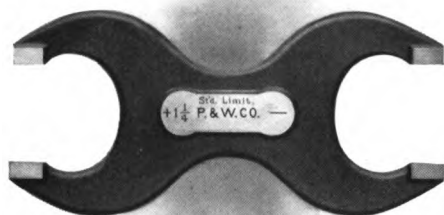


Fig. 1 (One-third Actual Size)

These gauges are the outgrowth of the efforts of the Master Car Builders' Association to insure uniformity in the sizes of round bar iron for U. S. Standard bolts, and the present form was suggested by the late Mr. Howard Fry, Superintendent of the Motive Power of the New York, West Shore & Buffalo Railway.

The variation, plus and minus, from the standard, is in accordance with the sense of the meeting of the Master Car Builders' Club, in New York, Dec. 21, 1882, with a slight modification approved by the committee on gauges, and adopted by vote of the association, November, 1883.

These caliper gauges are drop-forged from tool steel, and are hardened and ground to exact M. C. B. Standard limits.

These gauges are furnished in two complete sets of $\frac{1}{4}$ to $\frac{9}{16}$ inch by sixteenths, and $\frac{5}{8}$ to $1\frac{1}{4}$ inches by eighths, with reference standards and base, or in such sets without reference standards, or singly, as may be ordered. Limit gauge reference standards with base will also be furnished independently of caliper gauges, if so ordered.

The reference standards furnish a reliable test for double-end caliper gauges, when the latter are either worn or require adjustment; the latter may be readily done by stretching the outer curve with blows from a light hammer, within a reasonable limit of compensation. These standards are neatly mounted on cast-iron bases, as shown in the following engraving.

Double-end Limit Gauges

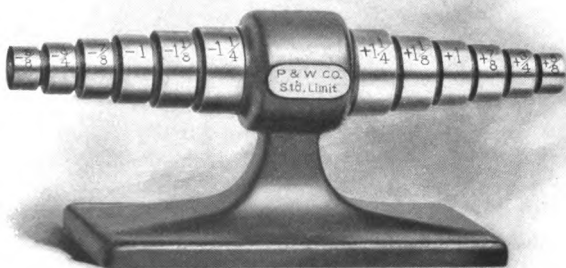


Fig. 2

Limit gauges for round iron, including reference gauge and base. Prices quoted on application.

Limit gauges, with or without reference standards, or reference standards only, $\frac{1}{16}$ to $1\frac{3}{16}$ inch, varying by sixteenths, to $1\frac{1}{4}$ to 2 inches, varying by eighths, made to order. All double-end caliper gauges to 2 inches are drop-forged steel. Prices quoted on application.

Circular Referring Specially to Master Car Builders' Standard
Limit Gauges for Round Bar Iron Intended for
United States Standard Bolts

One of the important conditions necessary to carry out successfully the interchangeable system of screw threads, known as the Sellers, Franklin Institute, or United States Standard, is that requiring the outside diameter of the thread of bolts to be exactly standard in size—a $\frac{3}{4}$ -inch bolt to be just $\frac{3}{4}$ inch, and not $\frac{3}{4}$ and $\frac{1}{84}$ or $\frac{1}{32}$ in diameter, and other sizes proportionately exaggerated, as is often the case.

To accomplish, practically, this result, it is necessary that round bar iron be rolled to sizes, within definite limits, which will impose the minimum work upon the dies of a bolt-cutter; under the larger limit avoiding the removal of an unnecessary amount of stock when threads are cut, and also, on the other hand, insuring the delivery of iron large enough to fulfill the requirements of this form of thread, within the other extreme – the latter cause for complaint being, however, rare as compared with that resulting from the oversize evil.

We quote a paragraph from the editorial columns of the *Railroad Gazette*, of July 20, 1883, under the title, "A Screw-thread Primer," in which special reference is made to this matter of limit gauges, and which concludes an able presentation of a remedy for a *non-interchangeable* screw-thread system :

"In adopting the Sellers, or Franklin Institute, or United States Standard, as it is variously called, a difficulty arose from the fact that it is the habit of iron manufacturers to make iron oversize, and as there are no oversize screws in the Sellers system, if iron is

too large, it is necessary to cut it away with the dies. So great is this difficulty that, as already explained, the practice of making taps and dies oversize has become very general. If the Sellers system is adopted, it is essential that iron should be obtained of the correct size, or very nearly so. Of course, no high degree of precision is possible in rolling iron, and, when exact sizes were demanded, the question arose how much allowable variation there should be from the true size. The matter was discussed at a meeting of the Master Car Builders' Club during the past winter, and after consultation with different iron makers it was concluded that there might be a variation of about 0.01 inch in the smaller sizes, 0.015 inch in $\frac{1}{2}$ -inch, and 0.02 inch in 1-inch iron. It was suggested, too, that limit gauges should be made for inspecting iron. It was proposed to make these of caliper form, with two openings, one larger and the other smaller than the standard size, and then specify that the iron should enter the large end and not enter the small one. After further discussion, it was agreed to make the difference in size of the large and the small end of the gauge for $\frac{1}{4}$ -inch iron 0.01 inch, and increase the difference by 0.001 inch for the sizes above that. The following table of dimensions for the limit gauges was therefore drawn up, and was recommended by the Master Car Builders' Association:

Size of Iron Inches	Size of Large End of Gauge	Size of Small End of Gauge	Difference in Size of Large and of Small Diameter of Iron
$\frac{1}{4}$	0.2550	0.2450	0.010
$\frac{5}{16}$	0.3180	0.3070	0.011
$\frac{3}{8}$	0.3810	0.3690	0.012
$\frac{7}{16}$	0.4440	0.4310	0.013
$\frac{1}{2}$	0.5070	0.4930	0.014
$\frac{9}{16}$	0.5700	0.5550	0.015
$\frac{5}{8}$	0.6330	0.6170	0.016
$\frac{3}{4}$	0.7585	0.7415	0.017
$\frac{7}{8}$	0.8840	0.8660	0.018
1	1.0095	0.9905	0.019
$1\frac{1}{8}$	1.1350	1.1150	0.020
$1\frac{1}{4}$	1.2605	1.2395	0.021

"The Pratt & Whitney Company took the matter up, and at the Chicago Exposition of Railway Appliances exhibited a complete set of such gauges, one of which is represented by Fig. 1.

"It is obvious, though, that, if used in inspecting iron, such gauges would soon wear so as not to be sufficiently accurate for the purpose for which they are intended. To provide for this, the

company has also made 'standard reference gauges,' Fig. 2, consisting of a series of cylindrical gauges, arranged like steps, those at one end being of the sizes of the small ends of the caliper gauges, and those at the other end the size of the large ends. Whenever it is suspected the caliper gauges have been injuriously worn, they can be tested on the reference gauge and the required correction made. In this way their accuracy can be maintained."

The Pratt & Whitney Company, having undertaken to make for the Master Car Builders' Association drop-forged double-end caliper gauges, embodying these limiting sizes, is prepared to furnish them in sets as may be desired, to manufacturers and users of U. S. Standard bolts and bolt iron. (See pages 179 and 180).

How to Use the Limit Gauges

The Company presents this explanation in the hope that, the object and purpose of these gauges being fully appreciated, the method of *using* them in the inspection of iron intended for U. S. Standard bolts may also be fully understood. It may be, therefore, only necessary to repeat what is so clearly stated in the foregoing quoted paragraph, that iron over which the small end of the caliper will easily go is *too small*, and iron which will not pass through the large end of the gauge is *too large*; consequently, iron that will *not* pass the small end but *will* pass the large end is correct within the limits given in the table.

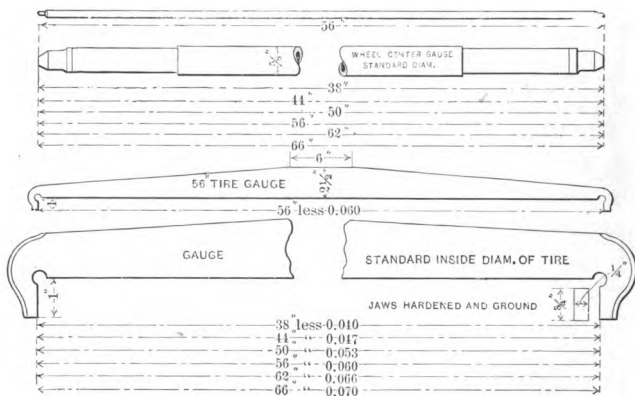
These limiting sizes have been submitted to the members of the Master Car Builders' Association, for their decision by letter ballot, under date of November 1, 1883, and by an almost unanimous vote were adopted.*

* See report of the proceedings of the seventeenth annual convention of the Master Car Builders' Association, held in Chicago, June, 1883.

Standard Locomotive Wheel-center and Tire Gauges

Adopted by the American Railway Master Mechanics'
Association, June, 1886

These gauges, which have been made in accordance with plans submitted to and approved by the committee of the association, embody their recommendation and adopted report relating to the proper diameters and amounts to allow for shrinkage for each size, the object of the committee being to reduce, as far as possible, the number of sizes, and to secure, by means



of standard gauges representing these adopted sizes, uniformity throughout the country. This is evidently impossible by the use of adjustable and ordinary working gauges, which have no better means of verification than an ordinary graduated scale, used under varying degrees of care and accuracy.

The standard diameters of the six sizes of centers and tires proposed by the committee, and adopted by the association, are as given above, the amount less for each size being the shrinkage allowance for boring tires, which, while insuring a tight fit, avoids the danger

of excessive shrinkage strains additional to those required to withstand actual service.

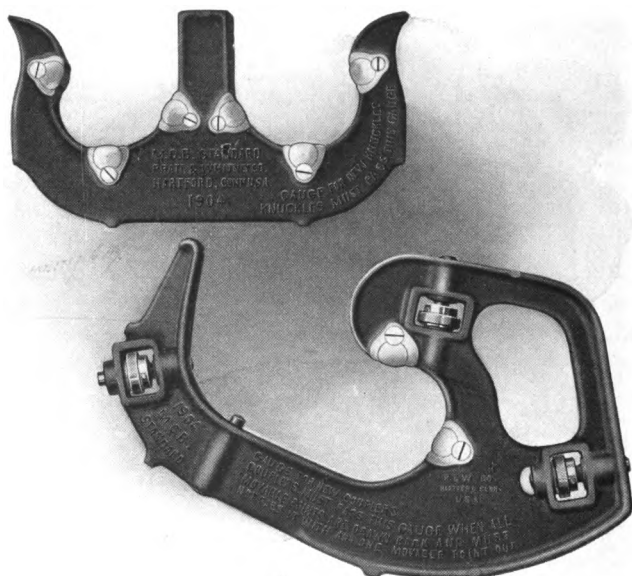
These gauges are for *reference only*, the gauges for centers being cold-drawn steel tubes, with hardened steel ends carefully ground to standard sizes given above, while the gauges for inside diameter of tire are of flat bar tool steel, with jaws hardened and ground to the diameters of centers, less the shrinkage allowance for each, also given on preceding page.

These gauges present the best and most practical form for reference, as they cannot possibly be used directly upon the work, but, as intended by the committee, are for testing and adjusting ordinary working gauges, or so-called "standard" wheel-center gauges, which, in their use, are certain to lose their size, and require invariable or reference standards for correcting them from time to time, if uniformity is to be successfully maintained.

Prices quoted on application.

Gauges for Automatic Couplers and New Knuckles

Master Car Builders' Standard



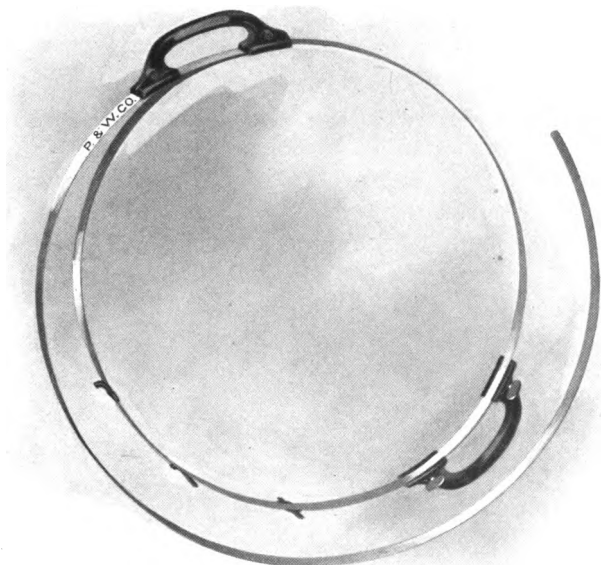
These gauges have been constructed under the direction of the executive committee of the M. C. B. Association, recommended by this committee at the annual convention, held at Saratoga, June, 1903, and adopted by the association through letter ballot, September of same year, to go into effect January 1, 1904.

All gauges are carefully inspected by means of steel templets which represent the standard contour and also the limits of variation allowed at the contact points, and are rigid within the limit necessary for practical inspection of coupler and knuckle castings. The contact points are tool steel, hardened and ground.

Price, per set, coupler and knuckle gauge.....	\$50 00
Price of coupler gauge only.....	30 00
Price of knuckle gauge only.....	20 00

Car Wheel Circumference Gauges

Master Car Builders' Standard



These gauges are made of flexible tempered steel ribbon, with convenient adjustable handles, and are graduated to obtain accurately, by circumference measurement, the standard diameters of car wheels from 24 to 42 inches, measured at the proper distance from the inside of the flange, as adopted by the Master Car Builders' Association.

The gauges are graduated to indicate variations of size by sixteenths of an inch in terms of the diameter, above and below for each regular size included, and will be found well adapted for the purpose for which they are designed.

Price of gauge graduated for 24, 26, 28, 30, 33, 36, 38 and 42-inch wheels	\$23 50
Price of gauge graduated for 24, 28 and 33-inch wheels.....	22 50
Price of gauge graduated for 33-inch wheel.....	21 50

Prices for gauges for other sizes of wheels quoted on application.

Gauges, receivers, dies and fixtures, for gun and sewing machine manufacture, and special work requiring duplication of parts, made to order.

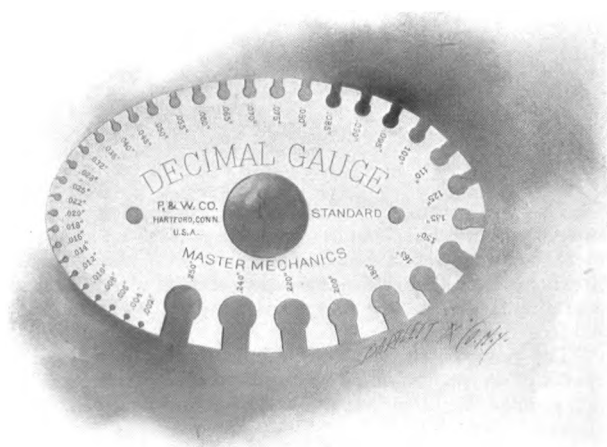
Standard thread gauges, U. S. form of thread, English or Metric pitch, for special purposes, for tools, for brass work, gun and sewing machine manufacture, and special work requiring interchangeability of screw threads, made to order.

Decimal Gauges

American Railway Master Mechanics' Association Standard

Patented June 30, 1896

Adopted by the American Railway Master Mechanics' Association of American Steel Manufacturers. Manufactured under license of the American Society of Mechanical Engineers, by Pratt & Whitney Co., Hartford, Conn., U. S. A.



All slots accurately ground after hardening.

Price, each..... \$10 00

Master Car Builders' Worn Coupler Limit and Wheel Defect Gauges

Adopted by the M. C. B. Association, September, 1904



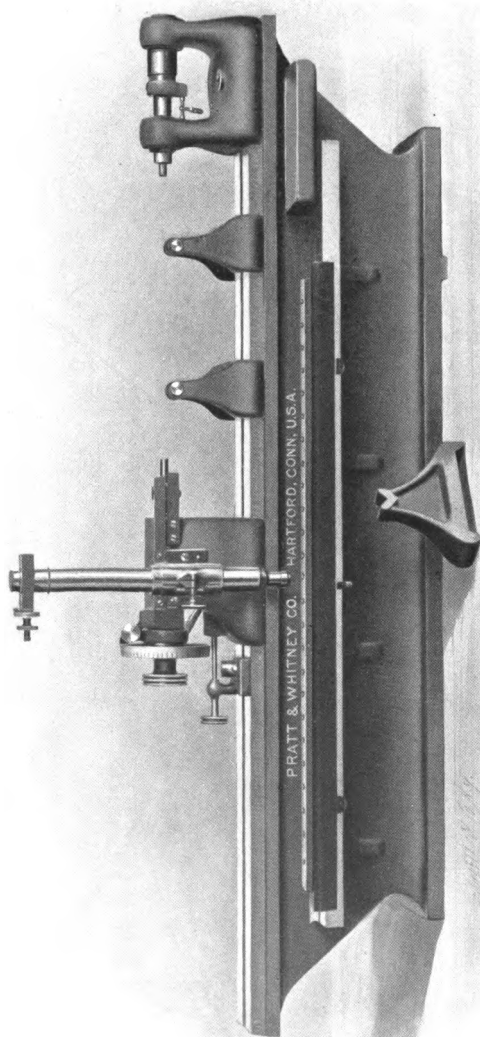
Double gauge, maximum and minimum limits. Price..... \$2 80

Master Car Builders' Standard Flange Thickness Gauges

Adopted by the M. C. B. Association, September, 1894



Maximum or minimum gauge. Price..... \$2 20



Standard Measuring Machines

Standard Measuring Machines

As an instrument of precision for originating gauge sizes, or for duplicating existing standards, this machine fully covers the requirements for purposes of accuracy within limits which are necessary and entirely practicable for this class of work.

The bed is massive, the weight, as now constructed, being nearly twice that originally made, and is supported on three neutral points, hence is not easily affected by changes of temperature or of flexure.

The sliding head, which includes the screw and index, is carefully fitted, to insure parallelism of the measuring faces at any position, up to the capacity of each machine.

The screw is standard, is 50 threads per inch, or one-half millimeter pitch for metric system, and has adjustment for compensation for wear in nut and shoulders.

Machines having metric screws are graduated to read to $\frac{1}{1000}$ millimeter ($\frac{1}{25000}$ inch, nearly).

The index circle is graduated to 400 divisions for English standard, and 500 for metric system, giving sub-divisions of $\frac{1}{20000}$ of an inch and $\frac{1}{1000}$ of a millimeter, respectively; while by estimation this may be further subdivided to indicate one-half or even one-quarter this small amount.

Delicacy of contact between the measuring faces is obtained by the use of auxiliary jaws holding a small cylindrical gauge by the pressure of a light helical spring which operates the sliding spindle, to which one of these auxiliary jaws is attached.

The behavior of this "sensitive piece" readily determines the uniformity of contact of the measuring faces at zero and upon the gauge which is measured between them.

An adjusting device for the index line is provided, to allow for slight variations of position of the measur-

ing faces at zero or for any convenient reading on the index circle.

Variations within a limit of $\frac{1}{100000}$ of an inch are readily determined by the use of this machine.

A recent important improvement, which includes a microscope and graduated steel standard bar attachment, avoids the use of end-measure standards for reference, and is particularly adapted and recommended for originating gauge dimensions.

The Standard Measuring Machines are furnished in sizes of 12-inch, 24-inch, 36-inch, 48-inch and 80-inch, measuring by .00005-inch from zero to capacity of machine, and in the metric system 300, 600, 1000, 1200 and 2000 millimeters capacity, by .001 of a millimeter, at prices which will be quoted on application.

Tables

Table of Decimal Equivalents

Of Eighths, Sixteenths, Thirty-seconds and Sixty-fourths
of an Inch

Eighths		Thirty-seconds		Sixty-fourths		Sixty-fourths	
$\frac{1}{8}$	.125	$\frac{1}{32}$	.03125	$\frac{1}{64}$	.015625	$\frac{33}{64}$	.515625
$\frac{1}{4}$	.250	$\frac{3}{32}$	.09375	$\frac{3}{64}$	.046875	$\frac{35}{64}$	.546875
$\frac{3}{8}$	.375	$\frac{5}{32}$	.15625	$\frac{5}{64}$	.078125	$\frac{37}{64}$	.578125
$\frac{1}{2}$	.500	$\frac{7}{32}$	.21875	$\frac{7}{64}$	.109375	$\frac{39}{64}$	.609375
$\frac{5}{8}$	.625	$\frac{9}{32}$	.28125	$\frac{9}{64}$	.140625	$\frac{41}{64}$	.640625
$\frac{3}{4}$	.750	$\frac{11}{32}$	.34375	$\frac{11}{64}$	.171875	$\frac{43}{64}$	.671875
$\frac{7}{8}$	.875	$\frac{13}{32}$	.40625	$\frac{13}{64}$	.203125	$\frac{45}{64}$	.703125
Sixteenths		$\frac{15}{32}$	.46875	$\frac{15}{64}$	.234375	$\frac{47}{64}$	.734375
		$\frac{17}{32}$	.53125	$\frac{17}{64}$	.265625	$\frac{49}{64}$	.765625
$\frac{1}{16}$	.0625	$\frac{19}{32}$	.59375	$\frac{19}{64}$	.296875	$\frac{51}{64}$	.796875
$\frac{3}{16}$	.1875	$\frac{21}{32}$	.65625	$\frac{21}{64}$	.328125	$\frac{53}{64}$	.828125
$\frac{5}{16}$	.3125	$\frac{23}{32}$	.71875	$\frac{23}{64}$	.359375	$\frac{55}{64}$	.859375
$\frac{7}{16}$	.4375	$\frac{25}{32}$	.78125	$\frac{25}{64}$	.390625	$\frac{57}{64}$	.890625
$\frac{9}{16}$	.5625	$\frac{27}{32}$	.84375	$\frac{27}{64}$	.421875	$\frac{59}{64}$	.921875
$\frac{11}{16}$	.6875	$\frac{29}{32}$	.90625	$\frac{29}{64}$	.453125	$\frac{61}{64}$	.953125
$\frac{13}{16}$	.8125	$\frac{31}{32}$	.96875	$\frac{31}{64}$	.484375	$\frac{63}{64}$	.984375
$\frac{15}{16}$	.9375						

Table of Decimal Equivalents of Millimeters and Fractions of Millimeters

$$\frac{1}{100} \text{ m/m} = .0003937 \text{ inch}$$

m/m	Inches	m/m	Inches	m/m	Inches
$\frac{1}{50}$	.00079	$\frac{26}{50}$	.02047	2	.07874
$\frac{2}{50}$	.00157	$\frac{27}{50}$	.02126	3	.11811
$\frac{3}{50}$	.00236	$\frac{28}{50}$	.02205	4	.15748
$\frac{4}{50}$	.00315	$\frac{29}{50}$	.02283	5	.19685
$\frac{5}{50}$	.00394	$\frac{30}{50}$	.02362	6	.23622
$\frac{6}{50}$	.00472	$\frac{31}{50}$	.02441	7	.27559
$\frac{7}{50}$	.00551	$\frac{32}{50}$	.02520	8	.31496
$\frac{8}{50}$	.00630	$\frac{33}{50}$	.02598	9	.35433
$\frac{9}{50}$	.00709	$\frac{34}{50}$	.02677	10	.39370
$\frac{10}{50}$	.00787	$\frac{35}{50}$	.02756	11	.43307
$\frac{11}{50}$	.00866	$\frac{36}{50}$	.02835	12	.47244
$\frac{12}{50}$	.00945	$\frac{37}{50}$	.02913	13	.51181
$\frac{13}{50}$	.01024	$\frac{38}{50}$	.02992	14	.55118
$\frac{14}{50}$	.01102	$\frac{39}{50}$	.03071	15	.59055
$\frac{15}{50}$	.01181	$\frac{40}{50}$	.03150	16	.62992
$\frac{16}{50}$	.01260	$\frac{41}{50}$	.03228	17	.66929
$\frac{17}{50}$	.01339	$\frac{42}{50}$	.03307	18	.70866
$\frac{18}{50}$	.01417	$\frac{43}{50}$	.03386	19	.74803
$\frac{19}{50}$	.01496	$\frac{44}{50}$	.03465	20	.78740
$\frac{20}{50}$	.01575	$\frac{45}{50}$	.03543	21	.82677
$\frac{21}{50}$	.01654	$\frac{46}{50}$	.03622	22	.86614
$\frac{22}{50}$	.01732	$\frac{47}{50}$	.03701	23	.90551
$\frac{23}{50}$	.01811	$\frac{48}{50}$	.03780	24	.94488
$\frac{24}{50}$	.01890	$\frac{49}{50}$	.03858	25	.98425
$\frac{25}{50}$	.01969	1	.03937	26	1.02362

$$10 \text{ m/m} = 1 \text{ centimeter} = 0.3937 \text{ inches}$$

$$10 \text{ cm.} = 1 \text{ decimeter} = 3.937 \text{ inches}$$

$$10 \text{ dm.} = 1 \text{ meter} = 39.37 \text{ inches}$$

$$25.4 \text{ m/m} = 1 \text{ English inch}$$

English Inches into Millimeters

Inch	0	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{8}$	$\frac{1}{2}$	$\frac{9}{16}$	$\frac{5}{8}$	$\frac{11}{16}$	$\frac{3}{4}$	$\frac{13}{16}$	$\frac{7}{8}$	$\frac{15}{16}$
0	0.0	1.6	4.8	6.4	7.9	9.5	11.1	12.7	14.3	15.9	17.5	19.1	20.6	22.2	23.8
1	25.4	27.0	30.2	31.7	33.3	34.9	36.5	38.1	39.7	41.3	42.9	44.4	46.0	47.6	49.2
2	50.8	52.4	55.6	57.1	58.7	60.3	61.9	63.5	65.1	66.7	68.3	69.8	71.4	73.0	74.6
3	76.2	77.8	81.0	82.5	84.1	85.7	87.3	88.9	90.5	92.1	93.7	95.2	96.8	98.4	100.0
4	101.6	103.2	106.4	108.0	109.5	111.1	112.7	114.3	115.9	117.5	119.1	120.7	122.2	123.8	125.4
5	127.0	128.6	131.8	133.4	134.9	136.5	138.1	139.7	141.3	142.9	144.5	146.1	147.6	149.2	150.8
6	152.4	154.0	157.2	158.8	160.3	161.9	163.5	165.1	166.7	168.3	169.9	171.5	173.0	174.6	176.2
7	177.8	179.4	181.0	182.6	184.2	185.7	187.3	188.9	190.5	192.1	193.7	195.3	196.9	198.4	200.0
8	203.2	204.8	208.0	209.6	211.1	212.7	214.3	215.9	217.5	219.1	220.7	222.3	223.8	225.4	227.0
9	228.6	230.2	233.4	235.0	236.5	238.1	239.7	241.3	242.9	244.5	246.1	247.7	249.2	250.8	252.4
10	254.0	255.6	258.8	260.4	261.9	263.5	265.1	266.7	268.3	269.9	271.5	273.1	274.6	276.2	277.8
11	279.4	281.0	282.6	284.2	285.7	287.3	288.9	290.5	292.1	293.7	295.3	296.9	298.4	300.0	301.6
12	304.8	306.4	309.6	311.1	312.7	314.3	315.9	317.5	319.1	320.7	322.3	323.8	325.4	327.0	328.6
13	330.2	331.8	333.4	335.0	336.5	338.1	339.7	341.3	342.9	344.5	346.1	347.7	349.2	350.8	352.4
14	355.6	357.2	358.8	360.4	361.9	363.5	365.1	366.7	368.3	369.9	371.5	373.1	374.6	376.2	377.8
15	381.0	382.6	384.2	385.8	387.3	388.9	390.5	392.1	393.7	395.3	396.9	398.5	400.0	401.6	403.2
16	406.4	408.0	409.6	411.2	412.7	414.3	415.9	417.5	419.1	420.7	422.3	423.9	425.4	427.0	428.6
17	431.8	433.4	435.0	436.6	438.1	439.7	441.3	442.9	444.5	446.1	447.7	449.3	450.8	452.4	454.0
18	457.2	458.8	460.4	462.0	463.5	465.1	466.7	468.3	469.9	471.5	473.1	474.7	476.2	477.8	479.4
19	482.6	484.2	485.8	487.4	488.9	490.5	492.1	493.7	495.3	496.9	498.5	500.1	501.6	503.2	504.8
20	508.0	509.6	511.2	512.8	514.3	515.9	517.5	519.1	520.7	522.3	523.9	525.5	527.0	528.6	530.2
21	533.4	535.0	536.6	538.2	539.7	541.3	542.9	544.5	546.1	547.7	549.3	550.9	552.4	554.0	555.6
22	558.8	560.4	562.0	563.6	565.1	566.7	568.3	569.9	571.5	573.1	574.7	576.3	577.8	579.4	581.0
23	584.2	585.8	587.4	589.0	590.5	592.1	593.7	595.3	596.9	598.5	600.1	601.7	603.2	604.8	606.4

39.37 inches = 1 m. = 10 dm. = 100 cm. = 1000 mm. 24.00 inches = 0.6096 m. 1 yard = 0.9144 m. 1 mile = 1609.3 m.

Different Standards for Wire Gauge in Use in the United States

Dimensions of Sizes in Decimal Parts of an Inch

No. of Wire Gauge	American or Brown & Sharpe	Birmingham or Stubs' Wire	Washburn & Moen Mfg. Co. Worcester Mass.	Trenton Iron Co. Trenton N. J.	Stubs' Steel Wire	U. S. Standard for Plate	No. of Wire Gauge
000000	.....	.....	.....	.....	.....	.46875	000000
00000	.....	.....	.....	.45	.....	.4375	00000
0000	.46	.454	.3938	.4	.....	.40625	0000
000	.40964	.425	.3625	.36	.....	.375	000
00	.3648	.38	.3310	.33	.....	.34375	00
0	.32486	.34	.3065	.305	.....	.3125	0
1	.2893	.3	.2830	.285	.227	.28125	1
2	.25763	.284	.2625	.265	.219	.265625	2
3	.22942	.259	.2437	.245	.212	.25	3
4	.20431	.238	.2253	.225	.207	.234375	4
5	.18194	.22	.2070	.205	.204	.21875	5
6	.16202	.203	.1920	.19	.201	.203125	6
7	.14428	.18	.1770	.175	.199	.1875	7
8	.12849	.165	.1620	.16	.197	.171875	8
9	.11443	.148	.1483	.145	.194	.15625	9
10	.10189	.134	.1350	.13	.191	.140625	10
11	.090742	.12	.1205	.1175	.188	.125	11
12	.080808	.109	.1055	.105	.185	.109375	12
13	.071961	.095	.0915	.0925	.182	.09375	13
14	.064084	.083	.0800	.08	.180	.078125	14
15	.057068	.072	.0720	.07	.178	.0703125	15
16	.05082	.065	.0625	.061	.175	.0625	16
17	.045257	.058	.0540	.0525	.172	.05625	17
18	.040303	.049	.0475	.045	.168	.05	18
19	.03589	.042	.0410	.04	.164	.04375	19
20	.031961	.035	.0348	.035	.161	.0375	20
21	.028462	.032	.03175	.031	.157	.034375	21
22	.025347	.028	.0286	.028	.155	.03125	22
23	.022571	.025	.0258	.025	.153	.028125	23
24	.0201	.022	.0230	.0225	.151	.025	24
25	.0179	.02	.0204	.02	.148	.021875	25
26	.01594	.018	.0181	.018	.146	.01875	26
27	.014195	.016	.0173	.017	.143	.0171875	27
28	.012641	.014	.0162	.016	.139	.015625	28
29	.011257	.013	.0150	.015	.134	.0140625	29
30	.010025	.012	.0140	.014	.127	.0125	30
31	.008928	.01	.0132	.013	.120	.0109375	31
32	.00795	.009	.0128	.012	.115	.01015625	32
33	.00708	.008	.0118	.011	.112	.009375	33
34	.006304	.007	.0104	.01	.110	.00859375	34
35	.005614	.005	.0095	.0095	.108	.0078125	35
36	.005	.004	.0090	.009	.106	.00703125	36
37	.004453	.....	.....	.0085	.103	.006640625	37
38	.003965	.....	.....	.008	.101	.00625	38
39	.003531	.....	.....	.0075	.099	.....	39
40	.003144	.....	.....	.007	.097	.....	40

Standard Dimensions of Wrought-iron Welded Tubes

Briggs Standard

Diameter of Tubes			Thickness of Metal Inches	Screwed Ends	
Nominal Inside Inches	Actual Inside Inches	Actual Outside Inches		Number of Threads per Inch	Length of Perfect Thread Inches
$\frac{1}{8}$	0.270	0.405	0.068	27	0.19
$\frac{1}{4}$	0.364	0.540	0.088	18	0.29
$\frac{3}{8}$	0.494	0.675	0.091	18	0.30
$\frac{1}{2}$	0.623	0.840	0.109	14	0.39
$\frac{3}{4}$	0.824	1.050	0.113	14	0.40
1	1.048	1.315	0.134	11½	0.51
1¼	1.380	1.660	0.140	11½	0.54
1½	1.610	1.900	0.145	11½	0.55
2	2.067	2.375	0.154	11½	0.58
2½	2.468	2.875	0.204	8	0.89
3	3.067	3.500	0.217	8	0.95
3½	3.548	4.000	0.226	8	1.00
4	4.026	4.500	0.237	8	1.05
4½	4.508	5.000	0.246	8	1.10
5	5.045	5.563	0.259	8	1.16
6	6.065	6.625	0.280	8	1.26
7	7.023	7.625	0.301	8	1.36
8	7.982	8.625	0.322	8	1.46
*9	9.000	9.688	0.344	8	1.57
10	10.019	10.750	0.366	8	1.68

Taper of conical tube ends, 1 in 32 to axis of tube ($\frac{3}{4}$ inch per foot).

The sizes of twist drills to be used in boring holes to be reamed with pipe reamer, and threaded with pipe tap, are as follows:

Size, Tap	Diameter, Drill	Size, Tap	Diameter, Drill
$\frac{1}{8}$ inch.....	$\frac{1}{8}$ inch	1¼ inches.....	1 $\frac{7}{16}$ inches
$\frac{1}{4}$ inch.....	$\frac{1}{8}$ inch	1½ inches.....	1 $\frac{3}{8}$ inches
$\frac{3}{8}$ inch.....	$\frac{9}{16}$ inch	2 inches.....	2 $\frac{3}{16}$ inches
$\frac{1}{2}$ inch.....	$\frac{5}{8}$ inch	2½ inches.....	2 $\frac{3}{4}$ inches
$\frac{3}{4}$ inch.....	$\frac{5}{8}$ inch	3 inches.....	3 $\frac{1}{8}$ inches
1 inch.....	1½ inches		

* By the action of the manufacturers of wrought-iron pipe and boiler tubes, at a meeting held in New York, May 9, 1889, a change in size of actual outside diameter of 9-inch pipe was adopted, making the latter 9.625 instead of 9.688 inches, as given in the table of Briggs' Standard pipe diameters.

Tap Drill Sizes for U. S. Standard Thread

Size Inches	Size of Drill	Size Inches	Size of Drill	Size Inches	Size of Drill
$\frac{1}{4}$	12	$\frac{5}{8}$	$\frac{3}{8}$	$1\frac{3}{8}$	$1\frac{1}{4}$
$\frac{1}{8}$	D	$\frac{3}{4}$	$\frac{5}{8}$	$1\frac{1}{2}$	$1\frac{1}{8}$
$\frac{3}{8}$	M	$\frac{7}{8}$	$\frac{4}{7}$	$1\frac{5}{8}$	$1\frac{3}{8}$
$\frac{1}{2}$	S	1	$\frac{6}{7}$	$1\frac{3}{4}$	$1\frac{1}{2}$
$\frac{1}{2}$	Y	$1\frac{1}{8}$	$\frac{6}{4}$	$1\frac{7}{8}$	$1\frac{5}{8}$
$\frac{9}{16}$	$\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{5}{4}$	2	$1\frac{3}{2}$

Dimensions for Twist Drills

For Boring Holes to be Threaded with U. S. F. Taps $\frac{1}{8}$ to $\frac{1}{4}$
Inch Diameter

Diameter Inches	No. of Threads to the Inch	Exact Diameter Bottom of Thread Inches	Gauge No. of Drill	Diameter Inches	No. of Threads to the Inch	Exact Diameter Bottom of Thread Inches	Gauge No. of Drill
$\frac{1}{8}$	60	.041	57	$\frac{1}{4}$	26	.200	6
$\frac{1}{8}$	64	.042	56	$\frac{5}{16}$	56	.055	53
$\frac{3}{16}$	48	.067	50	$\frac{5}{16}$	60	.056	53
$\frac{3}{16}$	50	.068	50	$\frac{7}{16}$	40	.077	46
$\frac{3}{16}$	56	.071	49	$\frac{7}{16}$	44	.080	45
$\frac{3}{16}$	60	.072	48	$\frac{7}{16}$	48	.082	44
$\frac{7}{16}$	40	.093	41	$\frac{9}{16}$	32	.100	38
$\frac{1}{2}$	44	.096	40	$\frac{9}{16}$	36	.105	36
$\frac{1}{2}$	48	.098	39	$\frac{9}{16}$	40	.108	34
$\frac{5}{8}$	32	.116	31	$\frac{1}{4}$	32	.131	29
$\frac{5}{8}$	36	.120	31	$\frac{1}{4}$	36	.136	28
$\frac{5}{8}$	40	.124	30	$\frac{1}{4}$	40	.139	28
$\frac{1}{2}$	24	.133	29	$\frac{1}{4}$	24	.149	24
$\frac{1}{2}$	28	.141	27	$\frac{1}{4}$	28	.157	21
$\frac{1}{2}$	30	.144	26	$\frac{1}{4}$	32	.162	19
$\frac{1}{2}$	32	.147	25	$\frac{1}{4}$	36	.167	18
$\frac{1}{2}$	36	.152	23	$\frac{1}{4}$	24	.180	13
$\frac{1}{2}$	24	.164	19	$\frac{1}{4}$	28	.188	10
$\frac{1}{2}$	28	.172	16	$\frac{1}{4}$	32	.194	8
$\frac{1}{2}$	32	.178	14	$\frac{1}{4}$	36	.198	7
$\frac{1}{2}$	36	.183	12	$\frac{1}{4}$	18	.193	9
$\frac{1}{2}$	18	.178	14	$\frac{1}{4}$	20	.201	5
$\frac{1}{4}$	20	.185	12	$\frac{1}{4}$	24	.211	3
$\frac{1}{4}$	22	.190	10	$\frac{1}{4}$	26	.216	2
$\frac{1}{4}$	24	.196	8	$\frac{1}{4}$	32	.225	1

Tap Drills

For Machine Screw Taps

These drills will give a thread near enough full for all practical purposes, but not a *full* thread.

Size of Taps	No. of Threads	Size of Drills	Size of Taps	No. of Threads	Size of Drills
2	48	51	12	24	19
2	56	49	13	20	19
2	64	49	13	24	15
3	40	49	14	20	16
3	48	48	14	22	13
3	56	44	14	24	9
4	32	48	15	18	13
4	36	45	15	20	10
4	40	44	15	24	6
5	30	44	16	16	13
5	32	43	16	18	10
5	36	41	16	20	6
5	40	40	16	24	2
6	30	41	17	16	7
6	32	37	17	18	4
6	36	36	17	20	2
6	40	33	18	16	3
7	28	35	18	18	2
7	30	34	18	20	A
7	32	31	19	16	1
8	24	34	19	18	B
8	30	30	19	20	D
8	32	30	20	16	C
9	24	30	20	18	E
9	28	29	20	20	H
9	30	28	22	16	H
9	32	27	22	18	J
10	24	28	24	14	K
10	28	26	24	16	L
10	30	24	24	18	N
10	32	24	26	14	N
11	24	24	26	16	O
11	28	21	28	14	Q
11	30	19	28	16	S
12	20	24	30	14	T
12	22	20	30	16	V

Constants for Finding Diameter at Bottom of Thread

Threads per Inch	U. S. Standard Constant	"V" Thread Constant	Threads per Inch	U. S. Standard Constant	"V" Thread Constant
64	.02030	.02706	16	.08119	.10825
60	.02165	.02887	14	.09279	.12372
56	.02320	.03093	13	.09993	.13323
50	.02598	.03464	12	.10825	.14434
48	.02706	.03608	11	.11809	.15746
44	.02952	.03936	10	.12990	.17321
40	.03248	.04330	9	.14434	.19245
36	.03608	.04811	8	.16238	.21651
32	.04059	.05413	7	.18558	.24744
30	.04330	.05773	6	.21651	.28868
28	.04639	.06186	5½	.23619	.31492
26	.04996	.06662	5	.25981	.34641
24	.05413	.07217	4½	.28868	.38490
22	.05905	.07873	4	.32476	.43301
20	.06495	.08660	3½	.37115	.49487
18	.07217	.09623	3	.43301	.57733

C = Constant for number of threads per inch.

D = Outside diameter.*

D^1 = Diameter at bottom of thread.

$$D^1 = D - C.$$

Example

Given outside diameter of U. S. S. screw thread, 2 inches; $4\frac{1}{2}$ threads per inch; find diameter at bottom of thread. $D = 2$ inches; for $4\frac{1}{2}$ threads U. S. S., constant, $C = .2886$; then diameter at bottom of thread, $D^1 = 2 - .2886 = 1.7114$ inches.

U. S. Standard Screw Threads

Diameter of Screw Inches	Threads per Inch	Diameter at Root of Thread Inches	Width of Flat Inches
$\frac{1}{4}$	20	.185	.0062
$\frac{1}{8}$	18	.2403	.0069
$\frac{3}{8}$	16	.2938	.0078
$\frac{1}{2}$	14	.3447	.0089
$\frac{3}{4}$	13	.4001	.0096
1	12	.4542	.0104
$1\frac{1}{8}$	11	.5069	.0114
$1\frac{1}{4}$	10	.6201	.0125
$1\frac{3}{8}$	9	.7307	.0139
$1\frac{1}{2}$	8	.8376	.0156
$1\frac{5}{8}$	7	.9394	.0179
$1\frac{3}{4}$	7	1.0644	.0179
$1\frac{7}{8}$	6	1.1585	.0208
2	6	1.2835	.0208
$2\frac{1}{8}$	$5\frac{1}{2}$	1.3888	.0227
$2\frac{1}{4}$	5	1.4902	.0250
$2\frac{3}{8}$	5	1.6152	.0250
$2\frac{1}{2}$	$4\frac{1}{2}$	1.7113	.0278
$2\frac{5}{8}$	$4\frac{1}{2}$	1.9613	.0278
$2\frac{3}{4}$	4	2.1752	.0313
3	4	2.4252	.0313
$3\frac{1}{8}$	$3\frac{1}{2}$	2.6288	.0357
$3\frac{1}{4}$	$3\frac{1}{2}$	2.8788	.0357
$3\frac{3}{8}$	$3\frac{1}{4}$	3.1003	.0385
$3\frac{1}{2}$	3	3.3170	.0417
4	3	3.5670	.0417
$4\frac{1}{8}$	$2\frac{7}{8}$	3.7982	.0435
$4\frac{1}{4}$	$2\frac{3}{4}$	4.0276	.0455
$4\frac{3}{8}$	$2\frac{3}{8}$	4.2551	.0476
5	$2\frac{1}{2}$	4.4804	.0500
$5\frac{1}{8}$	$2\frac{1}{2}$	4.7304	.0500
$5\frac{1}{4}$	$2\frac{3}{8}$	4.9530	.0526
$5\frac{3}{8}$	$2\frac{3}{8}$	5.2030	.0526
6	$2\frac{1}{4}$	5.4226	.0556

Metric Standard Screw Threads

Diameter of Screw m/m	Pitch m/m	Diameter at Root of Thread m/m	Width of Flat m/m
3	0.5	2.35	.06
4	0.75	3.03	.09
5	0.75	4.03	.09
6	1.0	4.70	.13
7	1.0	5.70	.13
8	1.0	6.70	.13
8	1.25	6.38	.16
9	1.0	7.70	.13
9	1.25	7.38	.16
10	1.5	8.05	.19
11	1.5	9.05	.19
12	1.5	10.05	.19
12	1.75	9.73	.22
14	2.0	11.40	.25
16	2.0	13.40	.25
18	2.5	14.75	.31
20	2.5	16.75	.31
22	2.5	18.75	.31
24	3.0	20.10	.38
26	3.0	22.10	.38
27	3.0	23.10	.38
28	3.0	24.10	.38
30	3.5	25.45	.44
32	3.5	27.45	.44
33	3.5	28.45	.44
34	3.5	29.45	.44
36	4.0	30.80	.5
38	4.0	32.80	.5
39	4.0	33.80	.5
40	4.0	34.80	.5
42	4.5	36.15	.56
44	4.5	38.15	.56
45	4.5	39.15	.56
46	4.5	40.15	.56
48	5.0	41.51	.63
50	5.0	43.51	.63
52	5.0	45.51	.63
56	5.5	48.86	.69
60	5.5	52.86	.69
64	6.0	56.21	.75
68	6.0	60.21	.75
72	6.5	63.56	.81
76	6.5	67.56	.81
80	7.0	70.91	.88

Weights

Of Square and Round Bars of Wrought Iron in Pounds Per
Linear Foot—*Kent*

Iron weighing 480 pounds per cubic foot. For steel add 2 per cent.

Thickness or Diam. in Inches	Weight of Square Bar One Foot Long	Weight of Round Bar One Foot Long	Thickness or Diam. in Inches	Weight of Square Bar One Foot Long	Weight of Round Bar One Foot Long	Thickness or Diam. in Inches	Weight of Square Bar One Foot Long	Weight of Round Bar One Foot Long
0			2 $\frac{1}{16}$	24.08	18.91	5 $\frac{3}{8}$	96.80	75.64
$\frac{1}{16}$	.013	.010	$\frac{3}{4}$	25.21	19.80	$\frac{7}{16}$	98.55	77.40
$\frac{1}{8}$	.052	.041	$\frac{1}{2}$	26.37	20.71	$\frac{1}{2}$	100.8	79.19
$\frac{3}{16}$	.117	.092	$\frac{7}{8}$	27.55	21.64	$\frac{9}{16}$	103.1	81.00
$\frac{1}{4}$	.208	.164	$\frac{1}{16}$	28.76	22.59	$\frac{5}{8}$	105.5	82.83
$\frac{5}{16}$	.326	.256	3	30.00	23.56	$\frac{1}{4}$	107.8	84.69
$\frac{3}{8}$	.469	.368	$\frac{1}{8}$	31.26	24.55	$\frac{3}{4}$	110.2	86.56
$\frac{1}{2}$	.638	.501	$\frac{1}{8}$	32.55	25.57	$\frac{1}{4}$	112.6	88.45
$\frac{5}{8}$	.833	.654	$\frac{1}{8}$	33.87	26.60	$\frac{1}{2}$	115.1	90.36
$\frac{3}{4}$	1.055	.822	$\frac{1}{4}$	35.21	27.65	$\frac{1}{8}$	117.5	92.29
$\frac{7}{8}$	1.302	1.023	$\frac{1}{8}$	36.58	28.73	6	120.0	94.25
1	1.576	1.237	$\frac{3}{8}$	37.97	29.82	$\frac{1}{8}$	125.1	98.22
$\frac{1}{16}$	1.875	1.473	$\frac{1}{8}$	39.39	30.94	$\frac{1}{4}$	130.2	102.3
$\frac{1}{8}$	2.201	1.728	$\frac{1}{2}$	40.83	32.07	$\frac{3}{8}$	135.5	106.4
$\frac{3}{16}$	2.552	2.004	$\frac{1}{8}$	42.30	33.23	$\frac{1}{2}$	140.8	110.6
$\frac{1}{4}$	2.930	2.301	$\frac{3}{8}$	43.80	34.40	$\frac{5}{8}$	146.3	114.9
$\frac{5}{16}$	3.333	2.618	$\frac{1}{4}$	45.33	35.60	$\frac{3}{4}$	151.9	119.3
$\frac{3}{8}$	3.763	2.955	$\frac{3}{4}$	46.88	36.82	$\frac{7}{8}$	157.6	123.7
$\frac{1}{2}$	4.219	3.313	$\frac{1}{8}$	48.45	38.05	7	163.3	128.3
$\frac{5}{8}$	4.701	3.692	$\frac{1}{8}$	50.05	39.31	$\frac{1}{8}$	169.2	132.9
$\frac{3}{4}$	5.208	4.091	$\frac{1}{8}$	51.68	40.59	$\frac{1}{4}$	175.2	137.6
$\frac{7}{8}$	5.742	4.510	4	53.33	41.89	$\frac{3}{8}$	181.3	142.4
1	6.302	4.950	$\frac{1}{8}$	55.01	43.21	$\frac{1}{2}$	187.5	147.3
$\frac{1}{16}$	6.888	5.410	$\frac{1}{8}$	56.72	44.55	$\frac{5}{8}$	193.8	152.2
$\frac{1}{8}$	7.500	5.890	$\frac{1}{8}$	58.45	45.91	$\frac{3}{4}$	200.2	157.2
$\frac{3}{16}$	8.138	6.392	$\frac{1}{4}$	60.21	47.29	$\frac{7}{8}$	206.7	162.4
$\frac{1}{4}$	8.802	6.913	$\frac{3}{8}$	61.99	48.69	8	213.3	167.6
$\frac{5}{16}$	9.492	7.455	$\frac{1}{2}$	63.80	50.11	$\frac{1}{8}$	226.9	178.2
$\frac{3}{8}$	10.21	8.018	$\frac{1}{8}$	65.64	51.55	$\frac{1}{4}$	240.8	189.2
$\frac{1}{2}$	10.95	8.601	$\frac{1}{2}$	67.50	53.01	$\frac{3}{8}$	255.2	200.4
$\frac{5}{8}$	11.72	9.204	$\frac{1}{8}$	69.39	54.50	9	270.0	212.1
$\frac{3}{4}$	12.51	9.828	$\frac{3}{8}$	71.30	56.00	$\frac{1}{2}$	285.2	224.0
2	13.33	10.47	$\frac{1}{4}$	73.24	57.52	$\frac{5}{8}$	300.8	236.3
$\frac{1}{16}$	14.18	11.14	$\frac{3}{4}$	75.21	59.07	$\frac{3}{4}$	316.9	248.9
$\frac{1}{8}$	15.05	11.82	$\frac{1}{8}$	77.20	60.63	10	333.3	261.8
$\frac{3}{16}$	15.95	12.53	$\frac{1}{8}$	79.22	62.22	$\frac{1}{8}$	350.2	275.1
$\frac{1}{4}$	16.88	13.25	$\frac{1}{8}$	81.26	63.82	$\frac{1}{4}$	367.5	288.6
$\frac{5}{16}$	17.83	14.00	5	83.33	65.45	$\frac{1}{2}$	385.2	302.5
$\frac{3}{8}$	18.80	14.77	$\frac{1}{8}$	85.43	67.10	$\frac{3}{4}$	403.3	316.8
$\frac{1}{2}$	19.80	15.55	$\frac{1}{8}$	87.55	68.76	11	421.9	331.3
$\frac{5}{8}$	20.83	16.36	$\frac{1}{8}$	89.70	70.45	$\frac{1}{2}$	440.8	346.2
$\frac{3}{4}$	21.89	17.19	$\frac{1}{4}$	91.88	72.16	$\frac{3}{4}$	460.2	361.4
$\frac{7}{8}$	22.97	18.04	$\frac{1}{8}$	94.08	73.89	12	480.0	377.0

To compute the weight of sheet steel: Divide the thickness, expressed in
thousandths, by 25; the result is the weight, in pounds, per square foot.

Table Giving the Amount of Taper in a Certain
Length, when the Taper per Foot is Given

Length of Tapered Portion	Taper per Foot										
	$\frac{1}{16}$	$\frac{3}{32}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	*.600	$\frac{5}{8}$	$\frac{3}{4}$	1	$1\frac{1}{4}$
$\frac{1}{32}$	.0002	.0002	.0003	.0007	.0010	.0013	.0016	.0016	.0020	.0026	.0033
$\frac{1}{16}$	.0003	.0005	.0007	.0013	.0020	.0026	.0031	.0033	.0039	.0052	.0065
$\frac{3}{32}$	.0007	.0010	.0013	.0026	.0039	.0052	.0062	.0065	.0078	.0104	.0130
$\frac{1}{8}$	.0010	.0015	.0020	.0039	.0059	.0078	.0094	.0098	.0117	.0156	.0195
$\frac{3}{16}$	.0013	.0020	.0026	.0052	.0078	.0104	.0125	.0130	.0156	.0208	.0260
$\frac{1}{4}$	.0016	.0024	.0033	.0065	.0098	.0130	.0156	.0163	.0195	.0260	.0326
$\frac{5}{16}$	.0020	.0029	.0039	.0078	.0117	.0156	.0187	.0195	.0234	.0312	.0391
$\frac{3}{8}$	.0023	.0034	.0046	.0091	.0137	.0182	.0219	.0228	.0273	.0365	.0456
$\frac{7}{16}$	.0026	.0039	.0052	.0104	.0156	.0208	.0250	.0260	.0312	.0417	.0521
$\frac{1}{2}$	.0029	.0044	.0059	.0117	.0176	.0234	.0281	.0293	.0352	.0469	.0586
$\frac{9}{16}$	.0033	.0049	.0065	.0130	.0195	.0260	.0312	.0326	.0391	.0521	.0651
$\frac{5}{8}$	.0036	.0054	.0072	.0143	.0215	.0286	.0344	.0358	.0430	.0573	.0716
$\frac{11}{16}$	.0039	.0059	.0078	.0156	.0234	.0312	.0375	.0391	.0469	.0625	.0781
$\frac{3}{4}$	.0042	.0063	.0085	.0169	.0254	.0339	.0406	.0423	.0508	.0677	.0846
$\frac{7}{8}$	.0046	.0068	.0091	.0182	.0273	.0365	.0437	.0456	.0547	.0729	.0911
$1\frac{1}{16}$	.0049	.0073	.0098	.0195	.0293	.0391	.0469	.0488	.0586	.0781	.0977
1	.0052	.0078	.0104	.0208	.0312	.0417	.050	.0521	.0625	.0833	.1042
2	.0104	.0156	.0208	.0417	.0625	.0833	.100	.1042	.125	.1667	.2083
3	.0156	.0234	.0312	.0625	.0937	.1250	.150	.1562	.1875	.250	.3125
4	.0208	.0312	.0417	.0833	.125	.1667	.200	.2083	.250	.3333	.4167
5	.0260	.0391	.0521	.1042	.1562	.2083	.250	.2604	.3125	.4167	.5208
6	.0312	.0469	.0625	.125	.1875	.250	.300	.3125	.375	.500	.625
7	.0365	.0547	.0729	.1458	.2187	.2917	.350	.3646	.4375	.5833	.7292
8	.0417	.0625	.0833	.1667	.250	.3333	.400	.4167	.500	.6667	.8333
9	.0469	.0703	.0937	.1875	.2812	.375	.450	.4687	.5625	.750	.9375
10	.0521	.0781	.1042	.2083	.3125	.4167	.500	.5208	.625	.8333	1.0417
11	.0573	.0859	.1146	.2292	.3437	.4583	.550	.5729	.6875	.9167	1.1458
12	.0625	.0937	.125	.250	.375	.500	.600	.625	.750	1.000	1.250
13	.0677	.1016	.1354	.2708	.4062	.5417	.650	.6771	.8125	1.0833	1.3542
14	.0729	.1094	.1458	.2917	.4375	.5833	.700	.7292	.875	1.1667	1.4583
15	.0781	.1172	.1562	.3125	.4687	.625	.750	.7812	.9375	1.250	1.5625
16	.0833	.125	.1667	.3333	.500	.6667	.800	.8333	1.000	1.3333	1.6667
17	.0885	.1328	.1771	.3542	.5312	.7083	.850	.8854	1.0625	1.4167	1.7708
18	.0937	.1406	.1875	.3750	.5625	.750	.900	.9375	1.125	1.500	1.875
19	.0990	.1484	.1979	.3958	.5937	.7917	.950	.9896	1.1875	1.5833	1.9792
20	.1042	.1562	.2083	.4167	.625	.8333	1.000	1.0417	1.250	1.6667	2.0833
21	.1094	.1641	.2187	.4375	.6562	.875	1.050	1.0937	1.3125	1.750	2.1875
22	.1146	.1719	.2292	.4583	.6875	.9167	1.100	1.1458	1.375	1.8333	2.2917
23	.1198	.1797	.2396	.4792	.7187	.9583	1.150	1.1979	1.4375	1.9167	2.3958
24	.125	.1875	.250	.500	.750	1.000	1.200	1.250	1.500	2.000	2.500

* Pratt & Whitney Standard Taper.

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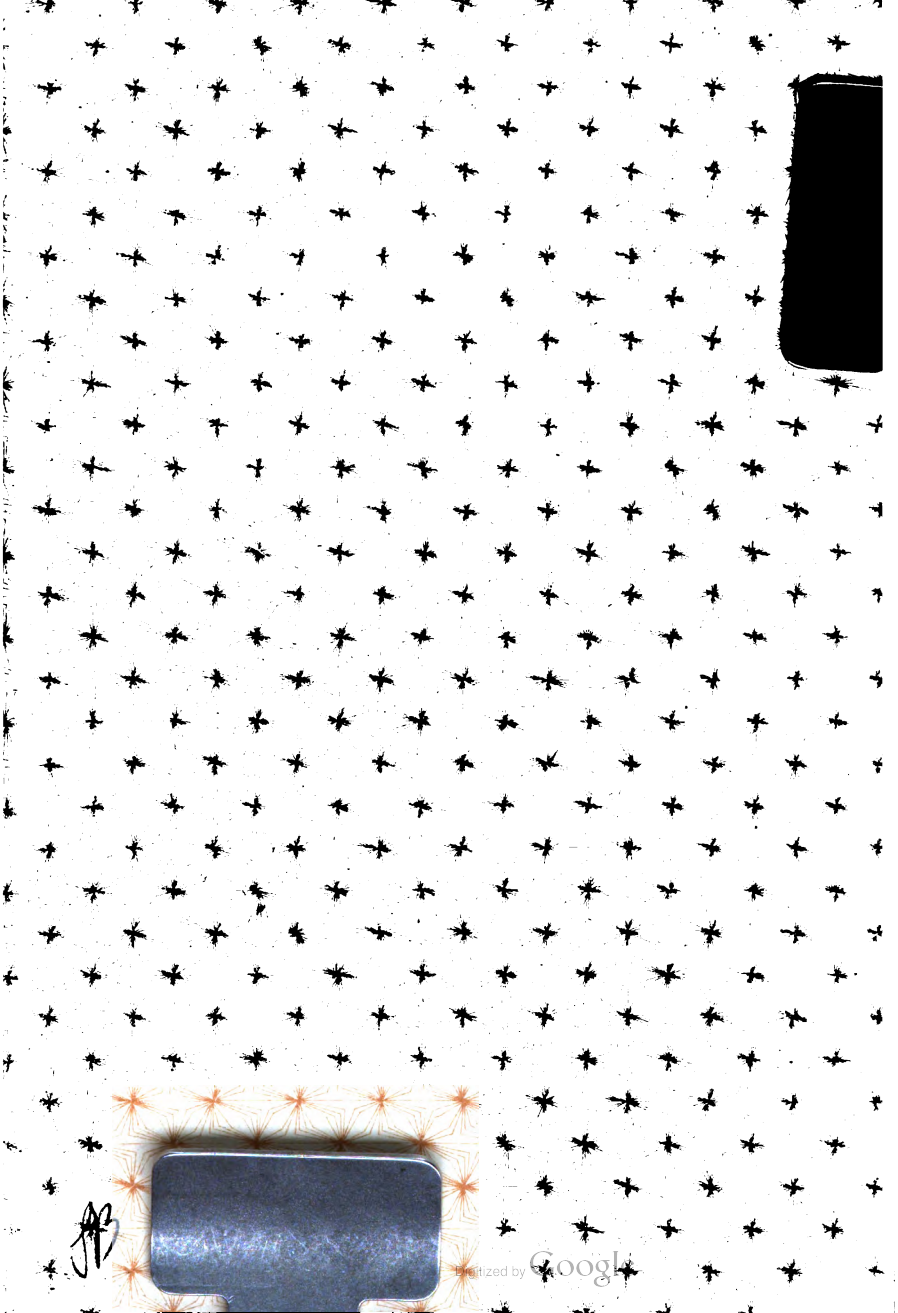
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